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# JOURNAL OF AGRICULTURAL EXTENSION MANAGEMENT

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**-Editor**

# JOURNAL OF AGRICULTURAL EXTENSION MANAGEMENT

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## CONTENT

# Construction of Knowledge Test to Measure the Knowledge Level of Farmers about Digital Technologies

**Manisha Ohlan[1] and Manju Dahiya[2]**

## ABSTRACT

*Knowledge is a familiarity, awareness or understanding of someone or something such as facts, information, descriptions or skills which were acquired through experience or education by perceiving, discovering or learning. To measure the knowledge level of farmers regarding digital technology in their agriculture farm, a knowledge test was developed on the basis of thinking and differentiation of well-informed farmers than poorly informed ones. Total of 37 items covering a list of digital technology was constructed. The obtained scores from each items were used for item analysis comprising item difficulty index and discrimination index. Total 21 items were selected in final scale having difficulty index ranging 20-80 and discrimination index above 0.20. Reliability of knowledge test was measured by split half method. The coefficient of correlation value in split half was 0.80 at 1 per cent level of significance. Developed knowledge test was found to be highly stable and dependable measurement.*

**Keywords:** Difficulty Index, Discrimination Index, Knowledge Test, Farmers Knowledge, Digital Literacy, Precision Agriculture.

## Introduction

Knowledge is a body of understood information possessed by an individual or by a culture. The use of digital technologies to integrate agricultural production from the paddock to the market is known as digital agriculture. These innovations will give the agricultural industry the resources and data it needs to make better decisions and increase productivity (Anonymous, 2021). Sensors, communication networks, unmanned aviation systems (UAS), artificial intelligence (AI), robotics, and other sophisticated machinery are all used, and the Internet of Things concepts are frequently used. From data collection to management and processing, as well as guidance and direction, each of these brings something useful to farming. This integrated framework provides new perspectives that improve the ability to make and execute decisions (Anonymous, 2017).

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According to the FAO, the world will need to produce 56 percent more food in 2050 than it did in 2010, assuming "business as usual" rise (FAO, 2017). Furthermore, the planet is confronted with issues such as hunger, climate change, food waste, and evolving dietary patterns (Godfray *et al*., 2010). The costs of replicating, transporting, recording, verifying, and searching for data are all reduced by digital technologies (Goldfarb and Tucker, 2017). Digital technologies can increase productivity in the agricultural value chain as costs decline. Knowledge is one of the key component of behaviour and as such holds an important role in the covert and overt behaviour of an individual. Hence, knowledge test about digital technology was developed to assess knowledge level of farmers in Karnal, Rohtak and Jhajjar districts of Haryana.

## Methodology

### Item Collection

The content of a knowledge test is composed of questions called items. Items for the test were compiled from different sources such as literature, field extension personnel, relevant specialists (Horticulturists, Entomologists, Pathologists and Extension educationists) and the researcher's own experience. The items were collected in relation to major fields. Care was taken to make sure that no crucial practice should be left out. The collected items were negotiated with research scientists of the concerned fields (Horticulture, Entomology, Pathology and Extension education) for relevance of the statements and for addition and alteration of the items. Keeping the following three criteria in view, the items were initially selected for developing knowledge test:

a) The item should provide thinking rather than simply rote memorization.

b) The item should differentiate the well informed farmers from the poorly informed farmers and should have certain difficulty value.

c) The items included should cover all the areas of knowledge about concerned field.

### Item Analysis

The item analysis used by Jha and Singh (1970) was carried out so as to yield three kinds of information, viz., "Index of item difficulty", "Index of item discrimination" and "Index of item validity". Index of item difficulty refers to the extent to which an item was difficult, while the index of item discrimination was computed to find out whether an item really discriminates a well-informed person from a poorly informed one. The index of item validity indicates how well an item measures or discriminates in agreement with the rest of the test.

The items was checked and modified on the basis of pretesting and administered to 30 respondents for item analysis. The respondents for administering the items were randomly

selected and were not included in the sample for final study. This was mainly done to avoid testing effect.

Each one of the 30 respondents, to whom the test was administered, was given a score 1 or 0 for each item, according to whether the answer was right or wrong and responses were also collected under multiple choice question system in which those respondents who gave correct answer was given score 1 and 0 for those who gave wrong answer. The total number of correct answers given by the respondent out of collected items was the knowledge score of the individual. After calculating the score obtained by 30 respondents, the scores were arranged from highest to lowest in order of magnitude.

These 30 respondents were divided into six equal groups, each groups having "5" respondents and were arranged in descending order of total scores secured by them. These groups were given names as G1, G2, G3, G4, G5 and G6, respectively. For item analysis, the middle two groups, i.e. G3 and G4 were removed. Only following four extreme groups with high and low scores were taken into account for the calculation of item difficulty and item discrimination indices:

$$\left.\begin{matrix} G_1 \\ G_2 \end{matrix}\right\} \text{ Groups with High Scores}$$

$$\left.\begin{matrix} G_5 \\ G_6 \end{matrix}\right\} \text{ Groups with Low Scores}$$

## Calculation of Difficulty Index ($P_i$)

The difficulty index of an item is defined as the proportion of respondents giving correct answer to that particular item. This was calculated by the following formula:

$$P_i = \frac{n_i}{N_i} \times 100$$

Where,

$P_i$ = Difficulty index in percentage of the $i^{th}$ item

$n_i$ = Number of respondents giving correct answer to $i^{th}$ item

$N_i$ = Total number of respondents

## Calculation of Discrimination Index ($E^{1/3}$)

The discrimination index can be obtained by computing the phi-coefficient as formulated by Perry and Michael (1951). Although, Mehta (1958) in using $\mathbf{E^{1/3}}$ method to find out item discrimination emphasized that this method was analogous to, and hence, a convenient substitute for the phi-coefficient. The **($E^{1/3}$)** was used in the research study.

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

Where,

$S_1$, $S_2$, $S_5$, and $S_6$ = The frequencies of correct answers in groups $G_1$, $G_2$, $G_5$ and $G_6$, respectively

N = Total number of respondents in the sample of item analysis

**Calculation of Biserial Correlation**

It was used for the test item validation, when the criteria of validity are regarded as internal consistency that is, the relationship of total score to a dichotomized response to any given item. Keeping this in view, with the help of following formula proposed by Guilford (1965), the Biserial correlation for each of the item was computed. The significance of the Biserial correlation coefficient was tested by using the formula given by Guilford (1965). The items which are found to be significant at 0.5 per cent level of significance was included in the final format of the knowledge test battery.

$$\mathbf{rbis} = \frac{\mathbf{M_p - M_q}}{\mathbf{6_t}} \times \frac{\mathbf{pq}}{\mathbf{y}}$$

Where,

$M_p$ = Mean of X values for higher group (Giving correct answer of particular item) in dichotomized variable

$M_q$ = Mean of X values for lower group (Giving wrong answer of particular item) in dichotomized variable

p = Proportion of cases in higher group (Giving correct answer of particular item)

q = Proportion of cases in lower group (Giving wrong answer of particular item)

y = Ordinance of the unit normal distribution curve with surface equal to 1.0 at the point of division between segments containing p and q proportion of the cases.

6t = Standard deviation

## Representative of the test

Though the aforesaid criteria were the focal consideration for the final selection of the knowledge items, the care was taken not to avoid the important aspects if any.

## Selection of items for test

Two criteria viz. item difficulty and item discrimination index were considered for selection of items in the final format of the knowledge test. In the present study, items with difficulty index ranging 20 to 80 and discrimination index above 0.20 were included

in the final knowledge test. Item difficulty index and Item discrimination index of all the 37 items were calculated and 21 items were selected for the final format of knowledge test.

## Reliability of the test

To measure the reliability of the test, the split-half technique was used. Coefficient of reliability between the two sets of scores was computed by Rulon's formula (Guilford 1954).

$$\boldsymbol{r = 1 - \frac{6^2 d}{6^2 t}}$$

Where,

$$6^2 d = \frac{\sum d^2 - \frac{(\sum d)^2}{N}}{N}$$

$$6^2 t = \frac{\sum t^2 - \frac{(\sum t)^2}{N}}{N}$$

**Correlation factor formula:**

$$\mathbf{rtt = \frac{2\,roe}{1+roe}}$$

Where,

rtt = Coefficient of reliability of original test

roe = Reliability of coefficient of odd and even score

## Split-half method

All the 21 items of the knowledge test were first arranged randomly and then divided into two halves. These two sets having 10 items each were administered to 50 respondents, separately. The coefficient of correlation between two sets of scores was computed and the 'r' value of 0.802124 was found to be significant at 1 percent level of significance for farmers having knowledge about digital technologies. The reliability co-efficient, thus obtained, indicated that the "Internal consistency" of the knowledge test developed for the study was quite high.

## Content validity of the test

The biserial correlation was regarded as a measure of test item validity. Significant and highly significant biserial correlation coefficient proved the construct validity of the items included in the knowledge test battery.

## Administering the knowledge test and measurement of level of knowledge

The final knowledge test was administered on the selected sample farmers. The knowledge of farmers regarding digital technologies was studied by using developed test. The responses were collected in two point continuum viz. Yes and No with weightage of 1 and 0, respectively. The responses were also collected under multiple choice question system in which those respondents who gave correct answer was given score 1 and 0 for those who gave wrong answer. Maximum score one could obtain was 100 and minimum could be 0. According to the arbitrary method, the respondents were grouped into the following five categories:

| No. | Category | Score Range |
|---|---|---|
| 1 | Very low | Up to 20 |
| 2 | Low | 21 to 40 |
| 3 | Medium | 41 to 60 |
| 4 | High | 61 to 80 |
| 5 | Very high | 81 to 100 |

**Table 1. Final selected statements on digital technologies**

| S.No. | Statements | P | E 1/3 | Biserial | Decision |
|---|---|---|---|---|---|
| 1 | Rotavator | 75.00 | 0.75 | 1.3019 | Selected |
| 2 | Digital Cultivator | 55.00 | 0.75 | 1.1147 | Selected |
| 3 | Hydrolytic Reversible M.B. Plough | 55.00 | 0.45 | 1.3367 | Selected |
| 4 | Paddy Disc Harrow | 50.00 | 0.60 | 1.2207 | Selected |
| 5 | Ripper | 90.00 | 0.30 | 1.2069 | Rejected |
| 6 | Sub-Soiler | 55.00 | 0.45 | 2.2453 | Selected |
| 7 | Shrub Master | 65.00 | 0.15 | 3.6325 | Rejected |
| 8 | Jcb | 80.00 | 0.60 | 1.1286 | Selected |
| 9 | Artificial Intelligence (Machine Learning) | 35.00 | 0.45 | 1.4900 | Selected |
| 10 | Channels Of Seed Selection | 60.00 | 0.00 | 1.1914 | Rejected |
| 11 | Zero-Till Seed Drill Machine | 65.00 | 0.45 | 1.1112 | Selected |
| 12 | Seed Coating Machine | 70.00 | 0.90 | 1.2914 | Selected |
| 13 | Trans Planter | 65.00 | 0.45 | 1.2132 | Selected |
| 14 | Power Tiller Operated Till Plant Machine | 70.00 | 0.60 | 1.2181 | Selected |

| S.No. | Statements | P | E 1/3 | Biserial | Decision |
|---|---|---|---|---|---|
| 15 | Seed Drill Machine | 100.00 | 1.05 | -1.3856 | Rejected |
| 16 | Zero Seed Cum Fertilizer Drill | 50.00 | 0.45 | 0.7972 | Selected |
| 17 | Drones | 95.00 | 0.45 | 1.0366 | Rejected |
| 18 | Robots | 75.00 | 0.60 | 2.2437 | Selected |
| 19 | Fertigation Machine Ferti 8.000 | 55.00 | 0.45 | 2.2707 | Selected |
| 20 | Sprinkler | 100.00 | 0.90 | 2.7729 | Rejected |
| 21 | Solar System | 100.00 | 0.90 | -0.7447 | Rejected |
| 22 | Sensors | 90.00 | 0.60 | 1.1629 | Rejected |
| 23 | Robots | 75.00 | 0.45 | 0.7645 | Selected |
| 24 | Rotary Slasher | 55.00 | 0.75 | 1.4185 | Selected |
| 25 | Robovator | 75.00 | 0.45 | 1.3632 | Selected |
| 26 | Inter-Row Rotary Cultivator For Inter-Row Weed Control | 80.00 | 0.75 | 3.4496 | Selected |
| 27 | Combine Harvester | 100.00 | 0.60 | 0.2177 | Rejected |
| 28 | Paddy Harvester | 100.00 | 0.90 | -0.9006 | Rejected |
| 29 | Paddy Straw Choppers | 100.00 | 0.75 | -1.1495 | Rejected |
| 30 | Stubble Shredder | 100.00 | 0.75 | -1.1919 | Rejected |
| 31 | Reaper-Binder | 100.00 | 0.90 | -1.4590 | Rejected |
| 32 | Mulcher | 85.00 | 0.45 | 0.7783 | Rejected |
| 33 | Baler | 80.00 | 0.30 | 0.8161 | Selected |
| 34 | Android Mobile Phone | 100.00 | 0.90 | -1.4768 | Rejected |
| 35 | GPS | 100.00 | 0.75 | -1.1919 | Rejected |
| 36 | e-NAM | 70.00 | 0.90 | 1.1510 | Selected |
| 37 | National Commodity Derivative Exchange (NCDEX)/ Multi-Commodity Exchange (MCX) | 35.00 | 0.45 | 1.2546 | Selected |

## Conclusion

Knowledge about digital technology among the farmers is very much essential to increase the adoption of technology, their income, productivity of farm at low cost and to maintain soil health. But, there is no such standard test available to assess the farmers' knowledge about digital technologies. So, present knowledge test for digital technology among adopting farmers is developed which is highly stable and dependent for measurement.

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# Plight of Dryland Farmers Amidst COVID Pandemic: A Rapid Assessment in Crisis Time

**Praveen Rapaka[1], G. Bhaskar[2] and B. Uday Kiran[3]**

## ABSTRACT

*This study aims to explore the problems faced by the farmers of KfW project during the COVID pandemic. The data was collected through cluster resource persons from 5 districts of Andhra Pradseh. A total of 280 respondents were selected randomly from the NICE database representing all five districts viz. Anantapur, Chittoor, Kadapa, Kurnool and Prakasam. The main objective of the study is to explore the difficulties of farmers during COVID and also to identify the information needs. After analyzing using descriptive analysis, the results showed the marketing problems, food insecurity, and strategies that farmers followed to market their produce during the lockdown. The study also shed light on the information needs and the preferred mode of receiving the information by farmers*

**Keywords:** Dryland Farmers, KfW Project, NICE Database, Andhra Pradesh

## Introduction

India is an agricultural country and about two thirds of our population is engaged in agriculture. Much of the global share of food staples such as rice and wheat goes from India, and almost half of the population in India depends on agriculture for their livelihood. Every year, farmers face risks such as low rainfall, price volatility and rising debts but risks from the COVID-19 pandemic are putting new challenges.

Pre-COVID our economy is slowing down compounding existing problems of unemployment, low incomes, rural distress, malnutrition and widespread inequality. Now the COVID has impacted all the sectors, the nationwide lockdown came at an unfortunate time. It has created labor problem as well as availability of equipments (Lindsay *et al)*. It has disrupted some activities in agriculture and supply chains. There are disruptions in supply chains because of transportation problems and other issues. Prices have declined for certain crops, yet consumers are often paying more (Lusk *et al*).

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This pandemic is an unprecedented challenge for India; its large population and the economy's dependence on informal labor make lockdowns and other social distancing measures hugely disruptive. The central and state governments have recognized the challenge and responded aggressively. The Andhra Pradesh Government is taking immediate measures to tackle the situation. However, in some districts the farmers are still facing problems. The most affected COVID-19 districts in AP are Kurnool, Kadapa, Nellore, Prakasam, Chittoor and Anantapuram. In these districts the farmers are lost their crops. The lost crops are Onions, Maize, Tobacco, Vegetables and various fruit crops like mango, lime, sweet lime, papaya and cashew etc. get losses on their crops. (NABARD 2020)

It is in this context a rapid assessment study was planned to reach out the farming communities to understand the difficulties faced due to lockdown and how they are coping with the pandemic.

## Materials and Methods

The respondents to the survey were randomly selected from the NICE database, who received advisories from KfW project partners. Five districts namely Anantapur, Chittoor, Kadapa, Kurnool and Prakasam districts were selected, where the KfW project is implemented. The primary data is collected by cluster resource persons of KfW project during June 2020 to August 2020. The farmers were selected through convenience sampling technique with the sample size of 280. The survey collected farmers' information on various socio economic factors, constraints during COVID and information needs. The collected data were analyzed by using frequency and percentages method. The main objective of this rapid assessment is to explore various problems faced by farmers during lock down and ascertain their information needs.

**Sample selection** N=280

| S.No. | District | Sample |
|---|---|---|
| 1 | Anantapur | 60 |
| 2 | Chittoor | 58 |
| 3 | Kadapa | 54 |
| 4 | Kurnool | 56 |
| 5 | Prakasam | 52 |

## Results and Discussion

Results of the study were presented in this section. The respondent's age, education and other socio personal characteristics are presented in Table 1 for general understanding of the context.

**Table 1: Socio-Personal Characteristics** N=280

| S. No. | Independent variables | Category | Respondents | |
|---|---|---|---|---|
| | | | Frequency | Percentage |
| 1 | Age | Young age (< 35 years) | 74 | 26.25 |
| | | Middle age (36-54 years) | 134 | 47.75 |
| | | Old age (> 55 years) | 72 | 25.75 |
| 2 | Education | Illiterate | 107 | 38.25 |
| | | Primary | 41 | 14.55 |
| | | Highs school | 85 | 30.25 |
| | | Graduate and above | 55 | 19.65 |
| 3 | Occupation | Only farming | 214 | 76.25 |
| | | Farming+ other | 67 | 23.75 |
| 4 | Family background | Urban | 10 | 3.55 |
| | | Semi urban | 52 | 18.45 |
| | | Rural | 219 | 78.25 |
| 5 | Household size | 1-3 | 124 | 44.25 |
| | | 4-6 | 219 | 78.25 |
| | | >6 | 52 | 18.45 |
| 6 | Crop | Grows staple crops | 68 | 24.25 |
| | | Grows Horticulture crops | 109 | 38.75 |
| | | Grows Cash crops (%) | 115 | 41 |

Among the respondent farmers, a considerable percentage was middle aged (47.75) followed by young age (26.25). The plausible reason for the above trend might be the young and middle aged farmers are enthusiastic in farming.

A glance of the above table revealed that 38 per cent of the farmers are illiterates and 30 percent of them had high school education followed graduates (19.25%) and the rest belonging to primary school (14.55%). The main occupation of the respondents is farming, In addition to farming 23 percent had other occupation. Majority (78.25) of the farmers hail from rural background followed by semi urban (18.45) and least number of the farmers residing in urban areas (3.55). Coming to size of the family a great deal of farmers are having 4-6 members in a family followed by 1-3 members in a family. The plausible reason might be due to fragmentation of lands, people migrating to cities for seeking employment. A great majority (41%) reported they are growing cash crops followed by horticultural

crops (38.75). The Rayalaseesma region is the highest producer of Groundnut, sunflower and vegetable crops. It also called as the horticulture hub of Andhra Pradseh.

**Table 2: Problems faced by Farmers during COVID Pandemic (multiple responses)**

N=280

| S.No. | Key concerns | Frequency | Percentage |
|---|---|---|---|
| 1 | Unable to send children to school | 70 | 25 |
| 2 | Shortage of money | 129 | 46 |
| 3 | Lack of access to health care | 154 | 55 |
| 4 | Unemployment | 190 | 68 |
| | **Food insecurity** | | |
| 1 | Increase in the food prices | 134 | 48 |
| 2 | Reduced intake of quality food | 118 | 42 |
| 3 | Unable to buy usual quantity of food shortage due to reduced income | 213 | 76 |
| 4 | Inadequate food for family | 31 | 11 |
| | **Crop related** | | |
| 1 | Lower yield | 70 | 25 |
| 2 | Poor quality of yield | 84 | 30 |
| 3 | Lack of labor for various activities on field | 182 | 65 |
| 4 | Problems in selling my harvest | 146 | 52 |
| 5 | Poor availability of major inputs | 126 | 45 |
| 6 | Increase in Pest attacks | 62 | 22 |
| 7 | Lack of money for purchasing inputs | 78 | 28 |
| | **Marketing** | | |
| 1 | Restrictions on movement and transport | 185 | 66 |
| 2 | Closure of mandis | 39 | 14 |
| 3 | Fall of prices | 95 | 34 |
| 4 | Labour shortage | 31 | 11 |

Nearly seventy percent of the respondents expressed unemployment as the main concern during the pandemic, Followed by lack of access to healthcare or medical care facilities (55%) and shortage of money (46%). The pandemic has affected farmers in many ways one of them is severe unemployment that caused due to restrictions in movement. Most of the farmers faced money shortage due to their dwindling financial resources. Slightly

more than half of the farmers expressed they are lacking access to health care the reason might be due to the government restriction on private hospitals for COVID treatment. Unable to send children to the schools is reported by 25 percent of the farmers. The government has ordered to close all the educational institutes as they a pose a risk in spreading the COVID. Due to the closure, the educational institutes leapfrogged to digital mode of learning.

Nearly eighty percent (76%) of the farmers expressed inability to buy the quantity of food they earlier did, due to drop in household income, or due to increase in the food prices (48%). Another 42 percent of the respondents shared that they reduced intake of quality food during the pandemic. A meagre portion (11%) reported that they are not experiencing any additional food insecurity due to the pandemic. The government must continue its initiative to provide free food ration during the pandemic through the Public Distribution System (PDS), Anganwadi Centers (AWCs) and other channels.

Table 2 shows the effects of pandemic on farming, 65 percent of the farmers expressed they are facing shortage of labor for carrying out the farming activities. Due to COVID restrictions the cropping calendar of operations has altered. Overall, 25 percent of the farmers claimed that they got less crop yield than the previous year. Slightly more than half (52%) of the farmers expressed that they are not be able to sell their entire harvested crop (40%) in the market. Nearly half of them (45%) reported they are not able to use inputs due to poor availability. A very meagre portion (22%) reported they are facing pest attacks, the fall army worm menace is still seen in fringes of Rayalaseesma. The rapid assessment study clearly revealed that COVID has impacted agriculture and farming sector adversely which will affect life and livelihood of famers in short and long-term. Due to transport restrictions and quarantine measures hampered the farmer's access to markets, limiting their productive capacities and hindering them from selling their produce. Shortages of labor is also identified as one of the major issues in disrupting timely harvesting and other essential supports.

Due to insecurity and fear, farmers, may face the disruptions in their production capacity and accessibility to farm inputs which may lead various implications like increase in price and making these resources inaccessible to them. The farmers also conveyed their apprehension on upcoming seasons. Due to this uncertainty and financial burden, farmers are hesitant to make new investments, and around 28 percent of the respondents are facing financial crisis.

Fig 1 shows that 66.66 percent farmers faced the problem of restrictions on movement and transportation. 34 percent farmers faced the problem of fall of prices of agricultural produce because of lower demand due to COVID-19. A meagre portion of farmers (14%) faced the problem of closure of local mandis and 11 percent of farmers faced the problem of lack of agricultural labour and equipment due to COVID-19 lockdown. Due to the

restrictions on movement and transportation and strict adherence to COVID-19 norms, farmers were unable to bring their agricultural produce to markets. Government imposed strict restrictions in intra and inter-state transport to prevent them from spreading of COVID.

With the restrictions on movement and transportation due to COVID-19 mainly the supply chain of agricultural produce has been affected significantly. Farmers have found it difficult to take their produce to the city-mandis and get a good price due to disruption of supply chain. Therefore, farmers should be encouraged to sell their agricultural produce in their local markets and rural areas with their mobile trucks.

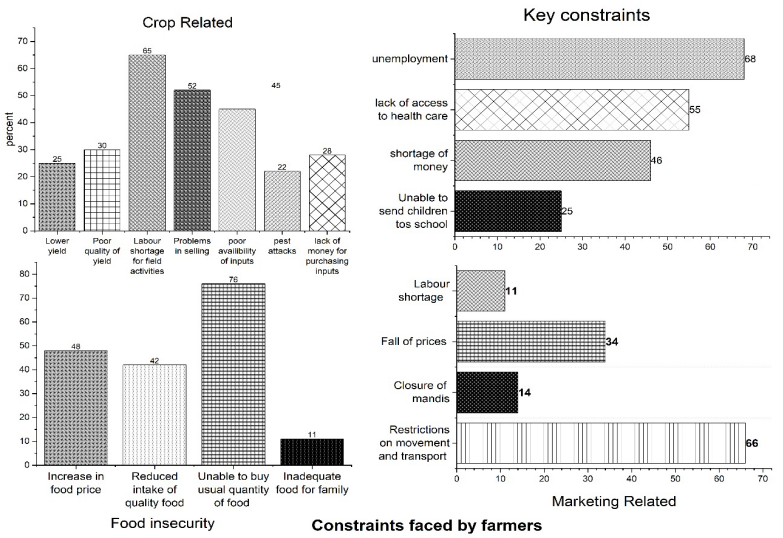


**Fig. 1. Constraints faced by the farmers during COVID Pandemic**

**Table 3: Information acquisition during COVID Pandemic**

N=280

| S.No. | Source of information | Frequency | Percentage |
|---|---|---|---|
| 1 | Digitally through IVR | 53 | 18.75 |
| 2 | WhatsApp | 45 | 16 |
| 3 | NICE messages | 68 | 24.25 |
| 4 | NGO personnel | 111 | 39.75 |
| 5 | Input dealers | 69 | 24.5 |
| 6 | Neighbor/ family | 118 | 42 |
| 7 | Mass media | 125 | 44.5 |
| 8 | Adarsha rytu | 101 | 36 |

A large proportion of farmers revealed that they are getting farming related information

through mass media , neighbors and also through farmer peers, followed by NGO personnel who are doing a great work in the drought affected areas of Rayalaseesma as shown in Table 3. About 36 for the respondents reported they are seeking information from Adarsha Rythu, who is an innovative farmer and serves like a knowledge repository in the village. An equal percent of farmers expressed they are getting information from input dealers and NICE services from the kfw project. It is interesting to note about 14 percent of the farmers told they are getting personal phone calls from extension personnel of state department though it is difficult to reach individual farmers the state department leveraged the digital tools for reaching the farmers. Nearly 20 per cent of Farmers revealed that they are sourcing information through WhatsApp and IVR.

**Table 4. Mode of Marketing**

N=280

| S.No. | Mode | Frequency | Percentage |
|---|---|---|---|
| 1 | Sales to retailers | 33 | 11.67 |
| 2 | Mobile agricultural marketing | 23 | 8.33 |
| 3 | Sales in Rythu Bharosa Kendra | 159 | 56.75 |
| 4 | Sales in weekly market | 52 | 18.66 |
| 5 | Roadside stands | 15 | 5.33 |

From the table 4, it is found that nearly sixty percent of farmers sold their produce in Rytu Bharosa Kendram, which is a operated by State Department of Agriculture to ensure fair price for the farmers and to eliminate middleman.

Followed by 8.33% of farmers have made use of mobile agricultural marketing to sell their produce in both rural areas and semirural towns, 18.66% of farmers sold their produce in weekly market, 11.67% of farmers sold their produce to retailers, 5.33% of farmers sold their produce near roadside stands.

**Table 5. Information needs of Farmers during COVID**

N=280

| S.No. | Type of information | Frequency | Percentage |
|---|---|---|---|
| 1 | Pest and disease management | 158 | 56.35 |
| 2 | Seed selection/Treatment | 104 | 37 |
| 3 | Weed management | 109 | 38.75 |
| 4 | Fertilizer management | 74 | 26.5 |
| 5 | Weather advisories | 79 | 28.25 |
| 6 | Government schemes | 147 | 52.6 |
| 7 | Market /Mandi prices | 136 | 48.5 |
| 8 | Post-harvest management | 101 | 36 |

Table 5 shows that the major agriculture related topics on which they sought advisories were pest and disease management (56%), Government schemes (52%) seed selection

and treatment (37%), weed management (38%), fertilizer management (26%) and Irrigation about 36 per cent expressed they need advisories on post-harvest management, like storage, quality grading, etc. There was a huge demand for updated information on mandi prices, which will help them in fetching better price in the market. A very meagre (28%) portion of them expressed interest on weather advisories.

Technology can also play a vital role in providing necessary advisories and information to farmers on real time market news and situations, thereby helping farmers to identify and contact those markets that are open and available for trade. Government can play a role in ensuring transparent information exchange between markets and farmers and technology service providers and social startups can play a critical role in developing necessary tools and processes to this effect.

The messages around government and other schemes available to farmers during the pandemic as well as the procedure to avail benefits under such schemes should be simplified so as to ensure easy access and understanding.

**Table 6: Preferred medium of receiving advisories**

N=280

| S.No. | Medium of receiving | Frequency | Percentage |
|---|---|---|---|
| 1 | In person/Direct | 230 | 82.25 |
| 2 | Live in phone call | 118 | 42 |
| 3 | WhatsApp based | 91 | 32.5 |
| 4 | Text message | 187 | 66.75 |
| 5 | YouTube | 158 | 56.5 |
| 6 | IVR | 68 | 24.25 |
| 7 | Android app | 25 | 8.75 |

Although a large proportion of farmers continued to prefer the advisories to be delivered in person (82%) in spite of the pandemic but practically it is not possible during the COVID situation, a great deal of farmers also opted for advisories to be delivered via live phone call (42%), WhatsApp videos (32%) and text messages on phone (66%). Around 24 per cent of farmers preferred advisories through IVR, with eight percent seeking through dedicated application for farm information as shown in table 6.

Many of the farmers expressed need for receiving timely, localized, easy to understand and tailor-made crop advisories in digital mode. The pandemic prevents in-person meetings, a preferred way for farmers to get agronomic advisories is only through digital mode.

It is critical that the agricultural messages are unified and that the farmers are getting timely advisories, throughout the crop season. Information disseminating agencies should consider enhancing the use of digital channels, like Pico projectors, WhatsApp and IVR, to make agronomic advisories reach the farmers. Private players and CSR organizations

can also be roped to support these initiatives with financial and technical support.

**Table 7. Support needed by the farmers during COVID Pandemic period**

N=280

| S.No. | | Frequency | Percentage |
|---|---|---|---|
| 1 | Free food rations | 136 | 48.5 |
| 2 | Safety equipment | 101 | 36 |
| 3 | Subsidized Agri inputs | 118 | 42.25 |
| 4 | Test facility | 63 | 22.5 |
| 5 | Medicines | 109 | 38.75 |
| 6 | Agronomic advisories | 125 | 44.5 |

Table 7 shows that majority of the farmers opined that they need access to agriculture related advisories (44%), subsidized agricultural input (42%) to ensure their economic security. Many farmers asked for free food rations for household (48%) for their food security. Access to healthcare information and services was also sought by the farmers. They need safety equipment, like masks, sanitizers and, medicines

The pandemic proved, the role of farmers in maintaining local food security, ensuring employment and contributing to local economies are critical. It is thus important to specially address the issues and concerns of farmers in a timely and effective manner as their production, market and economic actions are important for the larger revival and recovery of the society from the impact of pandemic.

## Implications and future strategies

The study highlights the problems faced by the farmers, constraints in marketing and also shed light on the information needs of the farmers, briefly outlined the strategies to offset them.

1. For facilitating easy marketing, innovative measures like roaming or mobile Mandis during lockdown may be operated, which will help farmers in cutting their transportation costs.
2. Taking Rythu Bharosa Kendra closer to farmers and ensuring that their produces are collected at regular intervals have multiple implications both for farmers as well as for consumers. Government can involve the FPOs, FIGs and DAESI trained input dealers as facilitators.
3. Usage of digital platforms has increased manifolds during pandemic, there is a huge potential to harness the digital tools in bridging existing gaps in farming. There is a concerted need to redefine approaches, particularly in harnessing of digital tools. The extension system should use blended approaches and bundle extension services with new partnership models.

4. There is urgent need to unify all the agencies like Line Departments, Agri Clinics, KVKs, agri-logistics service providers and agri-tech companies for providing services to the farmers.
5. Government at Center and States have announced number of schemes and relief packages including market stimulus packages. There is a need for concerted effort to inform the farmers on such programs. Government can help with standardized information and NGOs/FPOs and other actors can disseminate such information through digital communication platforms.
6. Corporate companies and business people can help farmers in this unprecedented situation by adopting villages near their plants and by extending school education, health and food support to rural households, either directly or through CBOs.
7. The Government should expand public health services and encourage private health services to increase coverage of COVID-19 testing and vaccination facilities in rural areas. In addition to health and nutrition workers, the Agricultural Extension Agents, FPOs, SHGs can also be engaged to deliver COVID-19 related advisories.

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# Need for Capacity Building of Farmers in Sarchi Village of Tirthan Valley of Himachal Pradesh

**Hitul Awasthi[1] and Pooja Thakur[2]**

## ABSTRACT

*In Sarchi village of Himachal Pradesh, a majority of people reside in rural areas and depend on natural resources for their livelihood. However, due to climate change, undulating topographical conditions, establishment of projects and lack of irrigation facilities, they are facing many challenges in sustaining their livelihood. In the present study, around 40 per cent of the farmers pointed out climate change as a major constraint in crop production followed by lack of irrigation facilities (33.33%), excessive chemical use (16.67%) and an increase in non farm income (10%). The Himachal Pradesh Horticulture Development Project introduced by the Government of Himachal Pradesh has proved to be a boon for the farmers of this area and has helped around fifty per cent of them to cope up with crop production constraints, while others shifted to vegetable production (30%) and tourism sector (16.67%). Due to the lack of skill and entrepreneurship development programmes in the agriculture sector, the farmers of Sarchi showed great interest in skill development courses like fruit production (36.67%), followed by capacity building in tourism (26.67%), vegetable production (16.66%), beekeeping (10%) and sericulture (10%). The present study focuses on major constraints in crop production faced by farmers of Sarchi and their adaptation to cope with these constraints. It also emphasises the immediate need to impart skill development training to farmers of Sarchi village for sustaining their livelihood.*

**Keywords**: Agriculture Skill Development, Tirthan Valley, GHNP, Capacity Building, Himachal Pradesh

## Introduction

Tirthan valley of Kullu district is the gateway to the Great Himalayan National Park and lies between $31^0$38'28"N and $31^0$54'58"N, and $77^0$20'11"E and $77^0$45'00"E with the altitudinal ranges from 2000 m to 5500 m above mean sea level (Pandey and Wells, 1997). The people residing in this valley are mostly poor and highly dependent on natural resources for sustaining their livelihoods. A survey conducted by Tandon (1999) revealed

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that around 80 per cent of the total households in Tirthan valley earn their livelihoods through the collection and sale of herbs, which was restricted after the formation of the park. The Sarchi village of Tirthan valley is represented by undulating topographical features. The light texture of soil and outward slope within the terraces contribute to the phenomena of soil erosion due to runoff water and consequently there is less infiltration of water, thus requiring irrigation facility for these soils through micro-irrigation.

The Agriculture Skill Council of India (ASCI) was established in 2013 and aims to bridge the gap between laboratories and farms by upgrading the skills of producers and labourers in agriculture and allied sector. ASCI has developed 116 qualification packs (QPs) for the agriculture and allied sector. Thus, to provide an alternative livelihood option to inhabitants of Tirthan Valley, the park authorities should take steps in collaborating with ASCI to impart capacity building training to farmers for sustainable development of Tirthan Valley.

## Material and Methods

A questionnaire regarding the perception of villagers on the decrease in crop yield, sustainable agricultural practices and qualifications packs (QPs) of Agriculture Skill Council of India was prepared for documentation. To gather information, individuals were selected randomly from the village and personal interviews were conducted with residents of Sarchi village of Tirthan Valley as shown in table 1.

**Table 1: Details of farmers randomly selected for interview (30 farmers)**

| S.No. | Farmer Name | Father Name | Mobile Number | Type of Farmer |
|---|---|---|---|---|
| 1 | Tej Pratap | Uttam Ram | 9816008553 | Marginal |
| 2 | Inder Singh | Tawasu Ram | 8627805709 | Marginal |
| 3 | Khem Raj | Dina Nath | 7876038349 | Marginal |
| 4 | Tape Ram | Balak Ram | 7018590711 | Marginal |
| 5 | Dineswer Prasad | Pyare Ram | 9405790698 | Marginal |
| 6 | Mohan Dev | Khem Dev | 9459999504 | Marginal |
| 7 | Mohan Lal | Bhagat Ram | 9418972301 | Marginal |
| 8 | Pritam Sharma | Jaisee Ram | 8894141578 | Marginal |
| 9 | Mool Chand | Pega ram | 9418722592 | Marginal |
| 10 | Murari Lal | Dina Nath | 8219954243 | Marginal |
| 11 | Hem Raj | Keshav Ram | 6230989079 | Marginal |
| 12 | Suresh Kumar | Khem Dev | 7807353697 | Marginal |
| 13 | Tek Ram | Uday Ram | 9418972291 | Marginal |
| 14 | Gulal Chand | Uttam Ram | 9559831798 | Marginal |

| S.No. | Farmer Name | Father Name | Mobile Number | Type of Farmer |
|---|---|---|---|---|
| 15 | Dev Raj | Uttam Ram | 9418612388 | Marginal |
| 16 | Rikam Chand | Bhed Ram | 9459721081 | Marginal |
| 17 | Dhavender Sharma | Brikam Chand | 8219763849 | Marginal |
| 18 | Kushal Chand | Brikam Chand | 8580730386 | Marginal |
| 19 | Krishan Dev | Jwala Das | 9805481661 | Marginal |
| 20 | Keshav Sharma | Jaisee Ram | 8219264728 | Marginal |
| 21 | Tilak Raj | Bhed Ram | 9805050070 | Marginal |
| 22 | Uttam Ram | Ram Singh | 7018618003 | Marginal |
| 23 | Kushal Sharma | Krishan Dev | 8580508395 | Marginal |
| 24 | Sunder Singh | Shyam Chand | 9857500031 | Marginal |
| 25 | Mansa Ram | Budhi Singh | 9816479037 | Marginal |
| 26 | Jagdev Thakur | Sher Singh | 8988603718 | Marginal |
| 27 | Karam Chand | Lal Das | 9418778486 | Marginal |
| 28 | Harish Kumar | Puran Chand | 8894034518 | Marginal |
| 29 | Thakur Singh | Teja Singh | 6230364807 | Marginal |
| 30 | Tejender Singh | Duni Chand | 8219686049 | Marginal |

## Results

The economy of Sarchi village is mostly dependent on horticulture crops, but due to climate change, coming up of Great Himalayan National Park, knowledge and skill gaps in modern agricultural practices, the residents are facing a threat to sustaining their livelihood.

## 2.1 Perception of people towards constraints in crop production

The economy of Kullu district mainly depends on horticulture, tourism and hydro-power generation, all heavily dependent on land resource utilization (Chandel *et al.,* 2013). It spatially extends between 31º20’ - 32º26’ N and 76º59’ - 77º50’ E, altitude varying from 750-6200 meters above mean sea level that increases from southwest to northeast, characterised by climate ranging from subtropical to alpine (Sah and Mazari, 2007). The acreage under orchards in the district has increased sharply from 675 ha in 1965 to 9477 ha in 2010. Singh (2003) discussed the role of changing weather patterns such as reduced annual snowfall and fluctuating temperatures during the flowering period in determining the success of the apple crop in Himachal Pradesh. Gautam *et al.* (2004) unearthed the factors of reduction in natural pollinating agents, inadequate winter chilling, frequent spring frost and hail, droughts as reasons for poor fruit setting in delicious variety of apple. Thus, farmers of Kullu valley have to shift to new cultivation practices to sustain their livelihood.

**Table 2: Major constraints in crop production**

| S.No. | Contraint | Perception (%) |
|---|---|---|
| 1 | Excess use of chemicals | 16.67 |
| 2 | Lack of Irrigation Facility | 33.33 |
| 3 | Climate Change | 40 |
| 4 | Increase in Non-Farm Income | 10 |

Himachal Pradesh is a mountainous state of India, where more than 70 per cent of the population is dependent on agriculture. Mountains being fragile environments are also rich repositories of biodiversity, water and providers of ecosystem goods and services to downstream communities. In the present study, people perceived a definite change in climate change and lack of irrigation facilities as major constraints in crop production. Out of thirty farmers interviewed, twelve (40%) farmers pointed out climate change as a major constraint in crop production followed by lack of irrigation facility (33.33%), excessive chemical use (16.67%) and non farm income (10%) as shown in table 2.

## 2.2 People's adaptation to changing scenario

Climate change has a dramatic impact on our natural resources. Realizing its importance the Indian Government launched a National Action Plan on Climate Change in 2008. Around 80 per cent of the residents of the Himalayas are predominantly dependent on rainfall for their livelihoods (Loria, 2016). Interview carried out in Kullu revealed that 95 per cent of the farmers perceive that the rain from monsoons is insufficient for irrigating crops and has become completely unpredictable in recent years. The yield of apples has been decreasing in lower belts due to climate change and there is a shift in apple belts to higher altitudes (IHCAP, 2016). Many people are shifting to the tourism sector, but risks due to natural calamities like floods and landslides due to climate change can pose a risk to the livelihood security of people (IHCAP, 2017).

In Himachal Pradesh, employment in horticulture has increased from 0.9 per cent to 28 per cent between 1983 to 2009-10. The strategic shift of government to high value horticulture and irrigation provides improved resilience against rainfall uncertainties and climate change. The World Bank funded Himachal Pradesh Horticulture Development Project (HPHDP) focuses on investments in production, processing, and marketing while improving service delivery in the horticulture sector. The project aims to enhance horticultural competitiveness at the farm level by supporting access to knowledge, technology and finance and providing disease free elite planting materials for sustainable intensification and diversification of horticultural production in Himachal Pradesh.

**Table 3: People's adaptation to crop production constraints**

| S.No. | Adaptation | Number (Percentage) |
|---|---|---|
| 1 | Shift to imported apple plants | 15 (50) |
| 2 | Shift to vegetable production | 9 (30) |
| 3 | Shift to Tourism | 5 (16.67) |
| 4 | Can't say | 1 (3.33) |

In interviews conducted to understand farmer's adaptation to crop production constraints, the study revealed that around fifty per cent shifted to cultivation of apple plants provided under HPHDP so as to sustain their livelihoods, while thirty per cent shifted to vegetable production, 16.67 per cent shifted to tourism sector and 3.33 per cent were unclear of how to resist such constraints as shown in table 3. It was revealed from the above study, that HPHDP has proved a boon for farmers of Sarchi village of Tirthan valley to cope with the crop production constraints and sustain their livelihood.

## 2.3 Job roles for entrepreneurship development in Sarchi village of Tirthan Valley

Himachal Pradesh Kaushal Vikas Nigam (HPKVN) was formed in the year 2015. It prepared and prioritized a road map for skill development, training and employment in the State of Himachal Pradesh. Skill development has become highly essential in agriculture to boost its productivity and revitalize the workforce. Appropriate skills empower communities, reduce wastage and increase profits by enhancing the quality of the produce.

**Table 4: People's perception towards entrepreneurship and skill development**

| S.No. | Job Role | Interested (%) |
|---|---|---|
| 1 | Beekeeping | 3 (10) |
| 2 | Sericulture | 3 (10) |
| 3 | Fruit production | 11 (36.67) |
| 4 | Vegetable production | 5 (16.66) |
| 5 | Tourism | 8 (26.67) |

In the present study as indicated in table 4, a majority of people showed great interest towards entrepreneurship and skill development in fruit production (36.67 %). In conventional fruit orchards, the fruit yields are decreasing due to climate change, but the new varieties introduced under HPHDP have helped farmers take up this venture as an enterprise. Skill development in fruit production was the most preferred choice of farmers for capacity building, followed by the tourism sector (26.67%), vegetable production (16.66%), beekeeping (10%) and sericulture (10%).

## Conclusion

Sarchi village is blessed with rich biodiversity and natural resources, but the plight of rural people is harsh as they have to face various challenges to sustain their livelihood. Around 40 per cent of farmers pointed out climate change as a major constraint in crop production followed by lack of irrigation facility (33.33%). To cope with these crop production constraints, the farmers shifted to cultivation of apple plants provided under HPHDP (50%), while others shifted to vegetable production (30%). The farmers also showed great interest in taking up entrepreneurship and skill development programmes in fruit production (36.67%), followed by tourism (26.67%), vegetable production (16.66%), beekeeping (10%) and sericulture (10%) so the government should take steps to provide skill trainings to these farmers on modern and scientific techniques of agriculture.

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# Digital Agricultural Services: The Future of Indian Farming

**G. Bhaskar**[1]

## ABSTRACT

*The advances in Information and Communication Technologies (ICTs) have shown the pathway to adopt digitisation in every aspect, in the services offered by both National and State Governments. The Agricultural sector is also taking a lead to bring huge changes in the utilisation of ICTs in agriculture. The Government of India has initiated a Mission Mode Project in Agriculture to develop ICT enabled services for farmers through a number of services that help the farmers in day-to-day activities. Further, the Digital Agricultural Mission focuses on using emerging technologies like Internet of Things (IoT), Robotics, Kisan Drones, Artificial Intelligence (AI), Machine Learning (ML), Blockchain technologies, Remote Sensing etc. These emerging digital agriculture services will enhance the farming activity and also provide better financial benefits. This paper discusses various digital agricultural services to strengthen the agricultural extension system.*

**Keywords:** National eGovernance Plan-Agriculture, Digital Agricultural Mission, Internet of Things, Artificial Intelligence, Machine Learning, Agri Drones, ICTs

## Concept of Digital Agriculture

Digital Agriculture is the use of Information and Communication Technologies and data Management Systems to support effective content development and delivery of timely, targeted information and services to the farmers and other stakeholders of agriculture to make farming a profitable business.

Digital agricultural services promote the use and application of the latest innovations in the area of ICTs in the agricultural extension system in order to improve the access to agricultural information and knowledge by officials working in agriculture and allied sectors and farmers. Digital technologies, such as Artificial Intelligence (AI) and Machine Learning (ML), remote sensing, big data, block chain and Internet of Things (IoT), are transforming agricultural value chains and modernizing operations. The recent evolution of digital technology in farming will further accelerate growth by ensuring higher crop yields and reducing input application such as agrochemicals and fertilisers on crops, which will ensure financial benefit to the farmer.

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To take the maximum benefit of the digital agricultural services the awareness of senior and middle level extension professionals needs to be improved on services like national and state level initiatives and their capacities developed on mobile apps, AI and Block chain, social media and documentation skills to enable them to provide effective extension support and services to farmers.

During the Budget speech 2022, it was announced that for the delivery of digital and hi-tech services to farmers by involving public sector research and extension institutions with private agri-tech players of agri-value chain, a scheme in Public Private Partnership (PPP) mode will be launched. Use of 'Kisan Drones' will be promoted for crop assessment, digitization of land records, and spraying of insecticides. The use of Drone technology for effective management of insect pests in farms has been emphasized in the Budget Speech.

## Digital Agriculture Initiatives of Government of India

The Government of India initiated a project - National e-Governance Plan in Agriculture (NeGP-A), which aims to develop national level agricultural service portals in India through the use of ICT, for timely access to agriculture related information to the farmers and other stakeholders in the system. Later, in the year 2021, the Government of India initiated Digital Agriculture Mission for projects based on new emerging technologies like artificial intelligence, block chain, remote sensing and GIS technology, use of drones and robots etc.

Details on the major National level portals under digital agriculture are given below:

| S. No. | Name of the digital service | Purpose | Benefits to farmers / officials |
|---|---|---|---|
| 1. | Farmers' Portal (www.farmer.gov.in) | An e-initiative to create a one-stop centre for meeting information needs of farmers relating to Agriculture, Animal Husbandry, Fisheries, and weather details. | The farmer portal facilitates solutions to farmers and stakeholders to access information relating to Seeds, pesticides, Farm Machinery, Fertilizers, Agromet advisory, market prices, insurance, storage, credit, risk management, percentage of irrigated and unirrigated area through maps, extension activities, beneficiary list under NHM and NFSM, MSP determination, programmes and schemes, farmer-friendly literature and videos. |

| S. No. | Name of the digital service | Purpose | Benefits to farmers / officials |
|---|---|---|---|
| 2. | mKISAN (www.mkisan.gov.in) | Mobile based services for agro-advisory dissemination to farmers | The mKisan portal is one of best portals in the world for using mobile based SMS communication to disseminate comprehensive advisory on agriculture and allied sector, schemes etc to the farmers by agriculture officials and scientists in the region in their own local language. |
| 3. | Soil Health Card (www.soilhealth.dac.gov.in/ | Soil Health Management is one of the most important interventions that aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilisers including secondary and micro nutrients in conjunction with organic manure and bio-fertilisers for improving soil health and its productivity. | The farmer gets the Soil Health Card (SHC) based on soil test results. The Soil health Card provides soil test based recommendations to farmers for improving soil fertility. The farmers can download the SHC and adopt the recommendations as per the SHC. |
| 4. | AGMARKNET project (www.agmarknet.gov.in)) | It is a farmer centric project which helps farmers to access agricultural marketing details such as commodity prices, arrivals etc of regulated markets of APMCs in the country. | AGMARKNET project has also been designated as one of the MMPs to provide information related to agriculture marketing prices to farmers and other stakeholders. |
| 5. | eNAM (NATIONAL AGRICULTURE MARKET) | Pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. | Services include live commodity arrivals & prices, buy & sell trade offers, location and number of mandis in each state through the map, Remote bidding by traders and access to arrivals and price related information |

| S. No. | Name of the digital service | Purpose | Benefits to farmers / officials |
|---|---|---|---|
| 6. | KisanRath (www.kisanrath.nic.in) | Facilitating Transportation of Agri produce - Connects farmers with the transport service providers, providing a wide range of trucks and tractor trolleys. | The app interfaces with major transport aggregators and also allows individual transporters to register their vehicles and provide services to farmers and traders. The requestor can view the responses to their posted loads and negotiate offline with the transporters to finalise the deal. |
| 7. | Crop insurance (pmfby.gov.in) | Crop insurance portal facilitates insurance for crops to the agriculture producers | Crop Insurance mobile app can be used to calculate the Insurance Premium for notified crops based on area, coverage amount and loan amount in case of loanee farmer. It can also be used to get details of the normal sum insured, extended sum insured, premium details and subsidy information of any notified crop in any notified area. |
| 8. | Kisan Suvidha | Kisan Suvidha is a mobile app developed to help farmers by providing relevant information to them quickly. | Unique features like extreme weather alerts and market prices of commodity in nearest area and the maximum price in the state as well as in India. With the click of a button, they can get the information on the weather of the current day and next 5 days, Agro advisories, plant protection, IPM practices etc. |
| 9. | KISAN CALL CENTRE (KCC) | To answer farmers queries on a telephone call in their own dialect using KCC | Respond to farmers queries and deliver various services related to agriculture and allied sectors in local languages by FTAs and Scientists of KCC |

| S. No. | Name of the digital service | Purpose | Benefits to farmers / officials |
|---|---|---|---|
| 10. | PM Kisan (pmkisan.gov.in) | PM Kisan is a Central Sector scheme to provide income support to farmers. Rs 6,000/- is disbursed in three equal installments in a year. | The fund is directly transferred to the bank accounts of the farmers. |

The proposed 'Kisan Drones' project by MoAFW, Government of India, can be used for assessing crop health, field areas inflicted by weeds, infections & pests, exact amounts of chemicals needed to fight these infestations that can be applied to optimize the cost for the farmer. Drone planting systems allow drones to shoot pods, their seeds and spray vital nutrients into the soil. Drones will increase consistency and efficiency of crop management, besides reducing the cost. It also reduces human exposure to hazardous working conditions. Drones, well-equipped with features like multi-spectral photo cameras, can be used in monitoring crop stress, plant growth, predict yields, and deliver props like herbicides and fertilizers.

To promote use of drones in Indian agriculture, Ministry of Agriculture & Farmers Welfare issued guidelines to make this technology affordable to the stakeholders of this sector. The "Sub-Mission on Agricultural Mechanization" was amended, which envisages granting up to 100 per cent of the cost of agriculture drone, or Rs. 10 lakhs, whichever is lesser, as grant for purchase of drones by the Farm Machinery Training and Testing Institutes, ICAR institutes, Krishi Vigyan Kendras and State Agriculture Universities for taking up large scale demonstrations of this technology on the farmers' fields.

Farmer Producers Organizations (FPOs) would be eligible to receive grant up to 75 per cent of the cost of the agriculture drone for its demonstration on the farmers' fields. Contingency expenditure of Rs.6000 per hectare would be provided to implementing agencies that do not want to purchase drones but will hire drones for demonstrations from Custom Hiring Centres, Hi-tech Hubs, Drone Manufacturers and Start-Ups. The contingent expenditure to implementing agencies that purchase drones for demonstrations would be limited to Rs.3000 per hectare.

To provide agricultural services through drone application, 40 per cent of the basic cost of the drone and its attachments, or Rs.4 lakhs, whichever is lesser, would be available as financial assistance for drone purchase by existing Custom Hiring Centers set up by Cooperative Society of Farmers, FPOs and Rural entrepreneurs. The subsidized purchase of agriculture drones for CHCs/Hi-tech Hubs will make the technology affordable to them, resulting in their widespread adoption.

## Role of MANAGE in implementing Digital Services

MANAGE ICT division is enriching the knowledge on digital agricultural services among the state level officers of agriculture and allied sector, scientists of KVK, SAU and other stake holders. Capacity building programmes have been organized on themes like e-Extension, Application of ICTs in Agriculture and Allied Sector, Mobile apps, e-Governance, e-Resources, e-Learning, Remote Sensing and GIS, Internet of Thing (IoTs), Artificial Intelligence and Block chain technologies. The knowledge on digital services initiated by MoA&FW, Government of India, has been provided to all the stakeholders in MANAGE training programmes. To promote digital literacy among officers, we are also promoting online education and MOOCs programme as Extension MOOCs. Extension MOOCs platform was developed and implemented for Massive Online Open Courses. This platform has been used by all the faculty, for developing course content for MOOCs and offering to various stakeholders of Agriculture and Allied Sectors.

We are also organizing capacity building programmes on video production skills and social media in agriculture in order to improve skills of agricultural professionals in state departments, ICAR, SAUs, KVKs, NGOs, agripreneurs, scholars and students from agricultural universities.

MANAGE ICT division also develops in-house software in response to the requirement of various centers, to implement Government of India Schemes such as DAESI, STRY, ACABC, CCINM, Incubation, PG Diploma programmes, projects and also the training programme management system, which makes use of digital services in MANAGE.

MANAGE is also implementing the GIZ-ProSoil project on “Digital Advisory Services to farmers in Maharashtra and Madhya Pradesh”. This project is supporting the farmers in terms of creating and disseminating localized, timely and quality content around crop management, soil, weather and climate related information in the agriculture sector, using an ICT based platform called NICE and a Mobile App by scientists of local KVKs and SAUs of the project area. The content has been created in the form of SMS, one page poster, Video URLs etc.

## Conclusion

The advent of Information and Communication Technologies has given opportunities to implement digital services in every sector, including the agricultural sector. The Government has started implementing ICT applications under NeGP-A to develop and streamline the content development and dissemination of agricultural information to the farmers and other stakeholders. The Digital Agricultural Mission has facilitated in taking advantage of emerging technologies like Artificial Intelligence, Block chain technologies, Internet of Things, Remote Sensing, Big data applications, and use of drones, robotics in agriculture. These technologies will not only help the farmer in accessing digital

agricultural services to simplify the farming practices but will also benefit in terms of cost of cultivation and additional income generation. The digital and Hi-Tech agricultural services can be provided by officials of departments, scientists and entrepreneurs. Input applications using drones can be supported by entrepreneurs by charging a minimum amount to farmers that would save a huge cost to farmers. The farmers are the ultimate beneficiaries of the digital agricultural services.

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# Suicide of Farmers and Farm Workers Amid COVID-19 in India

**Raghavendra RH[1], Anil Kumar R[2] and Shakunthala H[3]**

## ABSTRACT

*The purpose of the study is to examine the current scenario of farmers' suicide in India. Farmer suicides in India refer to the national catastrophe of farmers committing suicide since the 1990s. The farmers' suicide rate in India had ranged between 1.4 and 1.8 per 100,000 total population, over a 10-year period through 2005, however the coronavirus disease (COVID-19) has impacted not only physical health but also mental health and wellbeing globally. These impacts can be critically higher among marginalized individuals and populations like farmers and agricultural laborers in India. While most of them live in poor socioeconomic conditions, recent psychosocial challenges due to the COVID-19 lockdown had brought endless suffering in their lives. In this way, present study depicts about farmers and farm workers suicide amind COVID 19 India has been discussed.*

**Keywords:** Farmers Suicide, Agrarian Distress, Sustainable Development, Irrigation, Agrarian crisis.

## COVID-19 in India

The COVID-19 pandemic is the greatest global humanitarian challenge the world has faced since World War II. The virus has spread widely, and the number of cases is rising daily as governments work to slow its spread. India had moved swiftly, implementing a proactive, nationwide, lockdown, with the goal of flattening the curve and using the time to plan and resource responses adequately. India's effort to combat COVID-19 virus has been praised over the globe. However, the lockdown came with an economic cost and cascading impact on all the sections of society. The Covid-19 induced lockdown in India was a huge economic shock. It started across the country on 24 March 2020 and is still ongoing with restrictions in one form or other. It stalled the economy with complete closure imposed on enterprises across all sectors. Even though agricultural activities were

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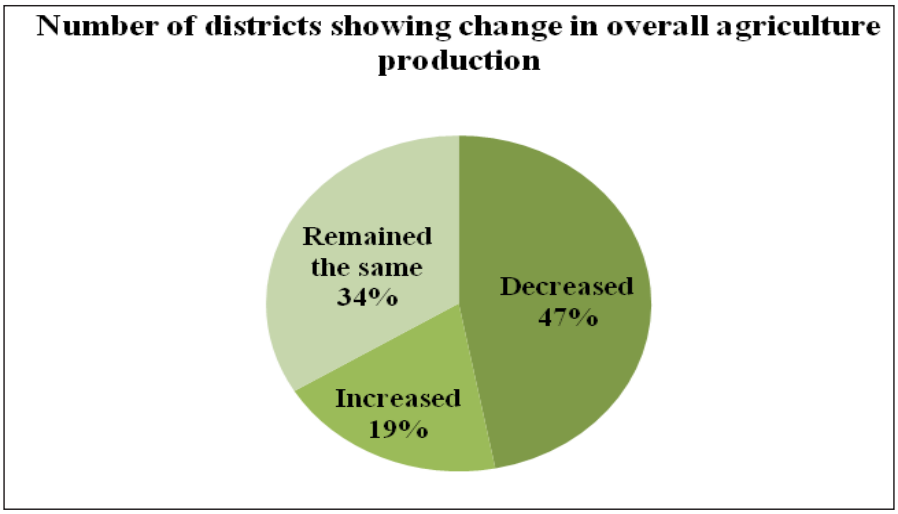
exempted, in the initial phases of the lockdown the agriculture value chain also faced large-scale disruptions. This had a serious detrimental effect on the farmers..

## Why Agriculture Sector Matters?

The agricultural & allied sector carries immense importance for the Indian economy. It contributes nearly one-sixth to the Indian national income and provides employment to nearly 50% of the workforce. It is fundamental for ensuring food security of the nation and also influences the growth of secondary and tertiary sector of the economy through its forward and backward linkages. Agricultural growth reduces poverty directly, by raising farm incomes, and indirectly, through generating employment and reducing food prices. In other words, a thriving agricultural sector is a boon for most sectors of the Indian economy.

## Impact of COVID 19 on farmers and farm workers

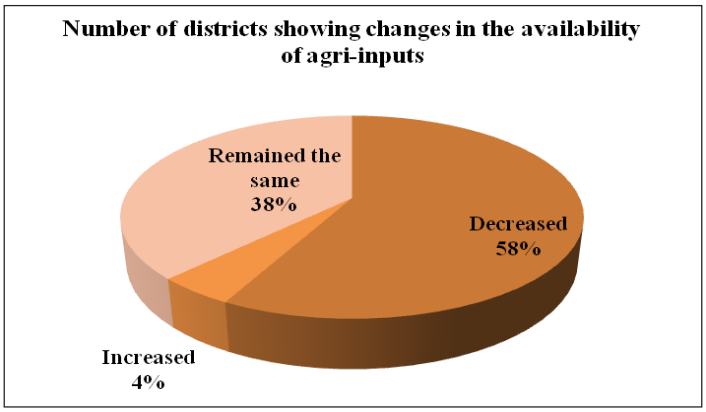
**a) Figure 1: Impact on Agriculture Production:**




Source: NABARD Survey on Impact Assessment of COVID-19 on Indian Agriculture and Rural Economy, 2020

Figure 1 shows the impact of lockdown imposed in the entire country owing to COVID-19 on the overall production levels in the agricultural and allied sector has been significant with overall production levels in the agriculture and allied sector declining in 47% of the sample districts. However, 19% of the districts have also reported an increase in the overall level of production in the sector and 34% of the districts have shown no change in the levels of production in the agriculture and the allied sector. Some of the reasons for decline in agricultural activities include lack of availability of labour and machines, need for social distancing, and restrictions on free movement of men and machineries..

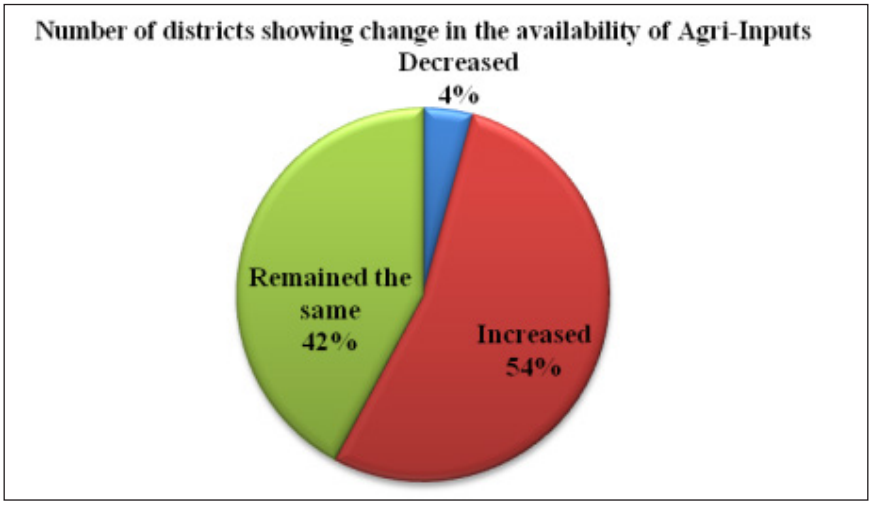
**b) Figure 2 Impact of COVID-19 on availability of Agri-inputs**




Source: NABARD Survey on Impact Assessment of COVID-19 on Indian Agriculture and Rural Economy, 2020

Figure 2 shows the impact of COVID 19 on the availability of agri inputs during the lockdown period has been discussed in the following paragraphs. The overall availability of agriinputs was reported to have declined in 58% of the sample districts and 38% of the total districts surveyed reported no change in the availability of agri-inputs, whereas only 4% districts reported an increase in the availability of Agri-inputs. The feedback on availability and prices of various agri-inputs viz. seeds, fertilizers, pesticides, rentals agricultural machinery, fodder/cattle feed, etc. were obtained to gain greater insights into the agriculture sector during the lockdown period.

**c) Figure 3 : Impact on the Prices of Agri-inputs**




Source: NABARD Survey on Impact Assessment of COVID-19 on Indian Agriculture and Rural Economy, 2020

Figure 3 shows the availability of agri-inputs had declined both at the all-India level and across the States. Theoretically, lower availability is expected to result in higher prices. The survey results also reflected a similar picture. The overall prices of agri-inputs showed an increase in 300 sample districts (54%) while 236 districts (42%) reported no impact of COVID-19 on the price levels of agri inputs and 24 (4%) districts reported a decline in the overall price levels of Agri-inputs.

**d) Impact on Marketing of Agricultural Produce:**

**a. Transporting Harvested Produce to APMCs/Mandis through Road Transport:**

The marketing of the harvested produce had been impacted adversely due to limitations of road transportation in many regions of India. Nearly 74 % of the all-India sample districts reported adverse impact on farmers' ability to haul their goods to APMCs/Mandis through road transport. The government had exempted (with initial restriction for 4-5 days) movement of essential goods from the restrictions imposed during the lockdown, thereby reducing the extent of adverse impact on ability of farmers to take the harvested produce to APMCs/Mandis through roads. In terms of the proportion of districts affected adversely, the impact was higher in the states of Kerala (100%), Jharkhand (95%) and Maharashtra (88%) than all India average.

**b. Collection of Harvested Produce by Private Agencies:**

Collection of harvested produce by private agencies had been impacted adversely in nearly 81% of the sample districts. Although movement of essential goods was exempted from the restrictions imposed during the lockdown, private transporters may have faced restrictions while traveling from cities to rural areas, thereby leading to a higher adverse impact on collection of harvested produce by private agencies. In terms of the proportion of districts reporting adverse impact, some of the smaller states had been severely impacted, with states such as Arunachal Pradesh, Sikkim, Meghalaya and Manipur reporting adverse impact in almost all their districts. Among other major states, Odisha (95%), West Bengal (94%), Kerala (92%) and Maharashtra (91%) were the states reporting higher proportion of districts with adverse impact.

**c. Organising Local Markets/Haats:** At all-India level, nearly 87% of the districts had reported an adverse impact on organisation of local rural weekly markets/haats. A large proportion of districts were affected adversely due to a complete ban on opening of rural haats by the local authorities. Several north-eastern states including Manipur, Meghalaya, Mizoram and Tripura had reported adverse impact in all of their sample districts. While organisation of weekly rural haats/markets was impacted adversely in only 17% of the districts in Kerala as against other major states reporting higher proportion of districts with adverse impact viz. Assam (100%), Chhattisgarh (100%), Odisha (100%), Rajasthan (95%) and Maharashtra (94%).

## COVID-19 and suicide of a farmer and farm workers in India

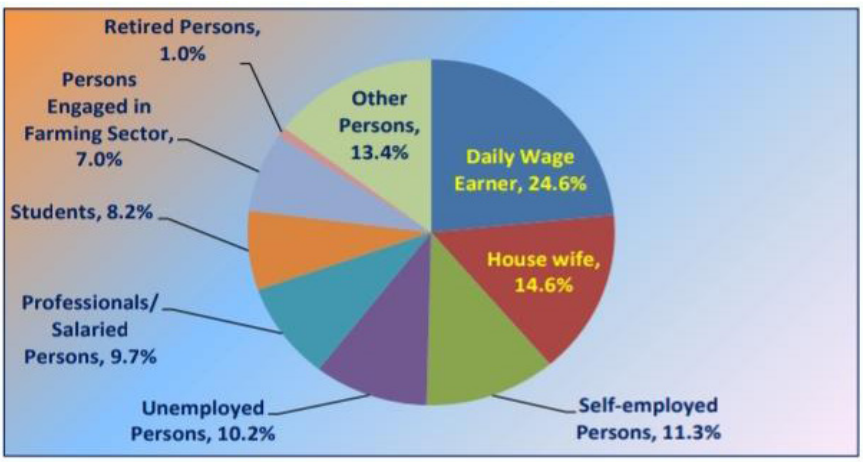
Randhir Singh was already deeply in debt when the coronavirus pandemic struck. Looking out at his paltry cotton field by the side of a railway track, he walked in circles, hopeless. In early May, he killed himself by lying on the same track. "This is what we feared," "The lockdown killed my father." said Rashpal Singh, Mr. Singh's 22-year-old son, choking back tears in his family home in Sirsiwala, a small village in the northern Indian state of Punjab.

Mr. Singh is trapped under a punishing debt of $20,000 that he accumulated over the years to keep his farm running. But farming, he said, is more unprofitable than ever. On a sweltering June afternoon, he walked gingerly through his parched fields. "Have you ever heard of a politician or an industrialist committing suicide?" he asked. "It's always a farmer or a laborer." (The NewYork Times, Sept, 2020)

COVID-19 is a rapidly evolving pandemic, with many rural and urban areas across the globe effectively shut down for most commerce and transport. Border closures, quarantines, and value chain disruptions are restricting food access, while shortfalls of inputs and the financial means to purchase them are jeopardizing production capabilities. Productivity is further threatened by emerging shortages of agricultural labour in some regions that may disrupt planting, harvest, and other farming operations.

India has one of the highest suicide rates in the world. In 2019, a total of 10,281 farmers and farm laborers died by suicide across the country, according to statistics from the National Crime Records Bureau. Taking one's own life is still a crime in India, and experts have said for years that the actual numbers are far higher because most people fear the stigma of reporting.

**Figure 4 Percentage Distribution of Suicide Victims by Profession during 2020 (All India)**




- As per data provided by States/UTs.

**Table 1: Persons Engaged in Farming Sector Suicides during 2020 (All India)**

| Profession | Male | Female | Transgender | Total | Percentage Share |
|---|---|---|---|---|---|
| **Persons engaged in farming sector** | **9956** | **721** | **0** | **10677** | **7.0** |
| **1. Farmers/Cultivators** | **5335** | **244** | **0** | **5579** | **3.6** |
| **a)** who cultivate their own land with or without assistance of agricultural labourers | 4737 | 203 | **0** | 4940 | 3.2 |
| **b)** who cultivate on leased land/work on lease/on other's land (known by different nomenclature) with or without assistance of agricultural labourers | 598 | 41 | **0** | 639 | 0.4 |
| **2.Agricultural Labourers** | **4621** | **477** | **0** | **5098** | **3.3** |
| **Total** | **9956** | **721** | **0** | **10677** | **7.0** |

Source: Accidental Deaths and Suicides in India, 2020 Report.

Figure 4 and Table 1 shows the majority of suicide victims engaged in farming sector were reported in Maharashtra (37.5%), Karnataka (18.9%), Andhra Pradesh (8.3%), Madhya Pradesh (6.9%) and Chhattisgarh (5.0%). A total of 10,677 persons involved in farming sector (consisting of 5,579 farmers/cultivators and 5,098 agricultural labourers) have committed suicides during 2020, accounting for 7.0% of total suicides victims (1,53,052) in the country. Out of 5,579 farmer/cultivator suicides, a total of 5,335 were male and 244 were female. Out of 5,098 suicides committed by agricultural labourers during 2020, 4,621 were male and 477 were female.

**Table 2: Farmers Suicides during 2020 (State & UT - wise)**

| S.No. | States | Male | Female | Trasnsgender | Total |
|---|---|---|---|---|---|
| 1 | Andhra Pradesh | 805 | 84 | 0 | **889** |
| 2 | Arunachal Pradesh | 07 | 00 | 0 | **7** |
| 3 | Assam | 117 | 0 | 0 | **117** |
| 4 | Bihar | 0 | 0 | 0 | **0** |
| 5 | Chhattisgarh | 499 | 38 | 0 | **537** |
| 6 | Goa | 01 | 0 | 0 | **01** |

| S.No. | States | Male | Female | Trasnsgender | Total |
|---|---|---|---|---|---|
| 7 | Gujarat | 121 | 5 | 0 | **126** |
| 8 | Haryana | 276 | 04 | 0 | **280** |
| 9 | Himachal Pradesh | 24 | 0 | 0 | **24** |
| 10 | Jharkhand | 13 | 04 | 0 | **17** |
| 11 | Karnataka | 1893 | 123 | 0 | **2016** |
| 12 | Kerala | 380 | 18 | 0 | **398** |
| 13 | Madhya Pradesh | 704 | 31 | 0 | **735** |
| 14 | Maharashtra | 3760 | 246 | 0 | **4006** |
| 15 | Manipur | 1 | 0 | 0 | **1** |
| 16 | Meghalaya | 3 | 2 | 0 | **5** |
| 17 | Mizoram | 4 | 0 | 0 | **04** |
| 18 | Nagaland | 0 | 0 | 0 | **0** |
| 19 | Odisha | 5 | 2 | 0 | **7** |
| 20 | Punjab | 245 | 12 | 0 | **257** |
| 21 | Rajasthan | 87 | 14 | 0 | **101** |
| 22 | Sikkim | 16 | 0 | 0 | **16** |
| 23 | Tamil Nadu | 401 | 76 | 0 | **477** |
| 24 | Telangana | 423 | 48 | 0 | **471** |
| 25 | Tripura | 0 | 0 | 0 | **0** |
| 26 | Uttar Pradesh | 158 | 14 | 0 | **172** |
| 27 | Uttarakhand | 0 | 0 | 0 | **0** |
| 28 | West Bengal | 0 | 0 | 0 | **0** |
| | **Total (States)** | **9517** | **821** | **0** | **10338** |
| | **Union Territories** | | | | |
| 29 | A & N Islands | 6 | 0 | 0 | **6** |
| 30 | Chandigarh | 0 | 0 | 0 | **0** |
| 31 | D & N Haveli | 6 | 0 | 0 | **6** |
| 32 | Daman & Diu | 0 | 0 | 0 | **0** |
| 33 | Delhi (Ut) | 0 | 0 | 0 | **0** |
| 34 | Lakshadweep | 0 | 0 | 0 | **0** |
| 35 | Puducherry | 0 | 0 | 0 | **0** |
| 36 | Jammu And Kashmir | 1 | 0 | 0 | **1** |
| | **Total (Uts)** | **11** | **0** | **0** | **11** |
| | **Total (All India)** | **9956** | **721** | **0** | **10677** |

Source: ADSI report, 2020

The rising spate of farmer suicides in different parts of India is not a new phenomenon. According to the recently released Accidental Deaths & Suicides in India (ADSI) report, 10,677 farmers committed suicide in 2020, accounting for 7 per cent of the total number of suicides in the country. Many states and union territories have reported nil data on suicides by farmers, cultivators and farm labourers.

Majority of suicides were reported in Maharashtra (4006) followed by Karnataka (2016), Telangana (471), Andhra Pradesh (889) and Madhya Pradesh (735) respectively. In other words Maharashtra accounted for the highest share in farm-related suicides at 37.5%, followed by Karnataka at 18.9%, Andhra Pradesh 8.3% and Madhya Pradesh at 6.9%, data showed. West Bengal, Bihar, Odisha, Uttarakhand, Meghalaya, Goa and Union territories, including Delhi, reported zero suicides by farmers/cultivators and agricultural labourers.

## Conclusion

India is an agrarian country with around 70% of its people depending directly or indirectly upon agriculture. Farmer suicides are an unfortunate result of the agrarian distress plaguing the rural economy of many states of the country. There are many reasons found on farmers' suicide, apart from COVID-19 and other factors, it is also found that climate change causes bad weather and erratic monsoon triggering more suicides in last 30 years. Thus, the problem needs to be tackled by helping agriculturists in suicide-prone areas in a way that would build productive and marketing capabilities. Also Adequate attention on yield, price, credit, as well as weather, health, life, crop and cattle insurance, besides improving water availability, rural electrification and timely intervention of a procurement mechanism needs to arresting the suicide death toll among farmers.

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# Doubling Farmers Income in India-Possibilities and Challenges

**N. Sujatha**[1]

## ABSTRACT

*The contribution of agriculture and allied sectors to GDP and GVA has been declined, but still remaining an important sector because of its contributed role in employment, providing raw materials to Agri based industries, in national food security and rural livelihood. As high as 70 percent of rural households still depends primarily on agriculture for their livelihood and getting subsistence level of incomes, some of farmers committed suicide. There are many reasons for lesser income in agriculture sector. Hence the central government aim to double farmers income by 2022-23 is central to promote farmers welfare and income. The central government has constituted the Dalwai Committee in April 2016 to recommend measures required to fulfil the target after Prime Minister Narendra Modi announced to double farmer's income in six years. In budget 2020-2021, Government provides 30% higher budget allocation for agriculture.in 2021-22 budget The ministry has been allocated Rs.1,31,531 Crore. The present study going to analyses the possibilities and challenger of doubling farmers income by 2022-23.*

**Keywords:** Doubling Farmers Income, DFI, Dalwai Committee, Agriculture, Agriculture Policy, India

## Introduction

In Indian contribution of agriculture sector to GDP/GVA has been declining. But still dominating and play an important role in employment, it has about 43 percent share in total workforce in 2019 and about 70 percent rural household depending on agriculture and allied activities for their livelihood in India. There is no correlation between share to the GVA&GDP and employment of agriculture sector. In this regard there is need to raise the farmers income to achieve economic growth. Therefore, the government of India concentrate on raise farmers income, aimed to Doubling Farmers Income by 2022-23 to promote farmer's welfare and income. Therefore, in present study going to analyze the possibilities and challenges of achieve the goal of Doubling Farmers Income [DFI] by 2022-23 in India and government initiatives to achieve it.

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## Need for the study

The central government has aimed at Doubling Farmers Income in six years i.e., by 2022-23. Hence government has constituted the Dalwai Committee in April 2016 to recommend measures required to achieve the target after Prime Minister announced to Doubling Farmers Income in six years (by 2022-23). Hence there is need to know why government concentrated on farmers income, initiatives taken by the government to achieve the target, possibilities and challenges.

## Objectives of the study

1. To analyze the present status of agriculture sector in Indian economy.
2. To review the recommendations of Dalwai Committee to Doubling Farmers Income by 2022-23; and
3. To analyze the possibilities and challenges to achieve the goal of DFI by 2022-23.

## Methodology

The data source of the present study is from secondary source only, including financial documents of government of India, NITI Aayog Papers, Dalwai Committee Report and Economic Survey of India. etc.

## Agriculture sector in India

In India the share of the agriculture sector to GVA has been declining. because of less productivity in agriculture sector, some other problem like improper supply chine in agriculture marketing lack of irrigation facilities for farming the agriculture sector share in GVA has been declined, the declining trends in Agriculture share to GVA presented in Table-1.

**Table 1: Agriculture share to GVA in India at current prices**

| Year | GVA in per cent |
|---|---|
| 2014-15 | 18.2 |
| 2015-16 | 17.7 |
| 2016-17 | 17.9 |
| 2017-18 | 17.2 |
| 2018-19 | 17.6 |
| 2019-20 | 18.4 |
| 2020-21 | 20.2 |

Source: Economic Survey 2019-20, Volume-I, Table-1. And National Statistical Office (NSO), M/O Statistics &PI

The Table-1 shows that the share of agriculture to GVA has been increased from 18.2% to 20.2 % between 2014-15 and 2019-20. It has increased 2% in six years.

In the process of economic transformation, a labour and other resources moving from lower productivity to higher productivity sector, and raising within-sector productivity growth. This kind of activities is a key driver of economic development. Agricultural productivity is also constrained by lower level of mechanization in agriculture, it is about 40 percent.

Indian agriculture sector plays a dominating role in employment. In 2019, 43.21 percent of workforce were engaged, in rural India it was about 70%. In 1950-51 was 82% declined. It is still remaining major source of employment. Half of the workforce in India depended on agriculture and allied activities remaining half distributed among two sectors. Table-2 shows a clear picture of agriculture share in employment it has been declined from 52.12 per cent to 43.21per cent between 2009 to 2019.

There is no correlation between Agriculture share in GVA and workforce in India.

**Table 2: Agriculture sector share in total Workforce in India** *(In Per Cent)*

| Year | Workforce in agriculture |
|---|---|
| 2009 | 52.12 |
| 2010 | 51.06 |
| 2011 | 48.96 |
| 2012 | 47.00 |
| 2013 | 46.06 |
| 2014 | 46.07 |
| 2015 | 45.56 |
| 2016 | 45.12 |
| 2017 | 44.52 |
| 2018 | 43.86 |
| 2019 | 43.21 |

Source: Distribution of the workforce across economic sector in India, published by H.Plecher.

According to Times of India, the latest PLFS report shows a sharp increase in employment in agriculture from 42.5% to Total employment in 2018-19 to 45.6% in 2019-20. This was not happened voluntary, it is a sign of distress in the labor market where the rest of the sectors are unable to provide employment.

## Doubling Farmer's Income [DFI]

The government of India has set a target of Doubling Farmer's Income by the year 2022-23 and constituted the DFI, and appointed the Dalwai Committee in April 2016 to recommend measures to achieve the target after PM Sri. Narendra Modi announced to double farmer's income in six years (by 2022). The committee has identified Seven Sources of Income growth as follows:

1. Improvement in crop productivity
2. Improvement in livestock productivity
3. Resource use efficiency or savings in the cost of production,
4. Increase in the cropping intensity
5. Diversification towards high value crops
6. Improvement in real price received by farmers and
7. Shift from farm to non-farm occupations.

Past strategy for development of the agriculture sector was focused primarily on raising agricultural output and food security did not recognize the need to raise the farmers income. When output raised that should reflect in farmers income, but actually in many cases farmers income did not increase much with increased in output in India. Therefore, the Government of India aimed to raise the farmers income by 2022 well known as Doubling Farmers Income (DFI), for that the committees constituted the Dalwai Committee in 2016 to recommend measures for DFI by 2022. The constituted submitted its Report to Government in September 2018 and an Empowered Body was constituted on January 23,2019 for monitoring the implementation of the DFI strategy.

## Government Initiatives for DFI

Government of India has taken several initiatives to achieve goal of DFI.

- Advocating progressive market reforms through the state governments for Up-gradation of Gramin Haats to work as centers of aggregation and for direct purchase of agricultural commodities from farmers.
- e-NAM to provide farmers an electronic online trading platform.
- Distribution of Soil Health Cards to farmers.
- Increase water efficiency through Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) as "Per Drop More Crop".
- Pradhan Mantri Fasal Bima Yojana (PMFBY) has better insurance coverage to crops for risk mitigations.
- Extended Kisan Credit Card for animal husbandry and fisheries related activities.

- Increased in the Minimum Support Price (MSP) for all Kharrif and Rabi crops for 2018-19.
- Providing old age pensions of Rs.3000/- to the eligible small and marginal farmers, on attaining age of 60 years. The Government of Indian has approved a budgetary provision of Rs.10,774.50 crore for the scheme till March 2022.
- Pradhan Mantri Samman Nidhi (PM-KISAN.)
- RBI raised the collateral free existing agriculture loan limit from Rs.1 lakh to Rs.1.60 lakh.

## Possibilities and Challenges

According to some experts, about DFI by the year 2022 has been dubbed as impossible and unrealistic. To achieve the goal of DFI, agriculture sector will require annual growth of 14.86 per cent per year for five years. This growth level hasn't been achieved even for one year in the history of Indian Agriculture.

There are many doubts on DFI like: Whether the nominal income is to be doubled or real income is to be double, whether targeted income includes only income derived from agriculture activities or would it also include income of farmers from other sources.

There are many challenges to achieve the goal of DFI.

- Informal supply chain
- Farmers do not keep produce for sale in lean months.
- Lack of warehouse.

According to ICAR-CIPHET, harvest and post-harvest losses for major food commodities covering crops, livestock and fish was Rs.92651 crores during the year 2013-14, post -harvest losses at a very high level, much of this loss is preventable by providing infrastructure facilities like storage and cooling and efficient logistics etc.

According to NITI Aayog policy paper-2017, if the technology, input prices, wages and labour use could result in per unit cost saving, then farmer's income would raise at a much higher rate than the output and another one is to raise the formers income is the relative increase in prices of farm products than the prices of non-agricultural products.

The government intention seems to be doubling the income of farmers from farming in real terms, because if the inflation in agricultural prices is high farmers income in nominal terms will double in a much shorter period but it is not good real growth.

In the study of Chand et al (2015) reported that increase in production rise in real farm prices and shift of labour force from agriculture are the important determinants of growth in farm income and also founded that the level of farm income was crucial to address agrarian distress.

According to Situation Assessment Survey of Agricultural Households (SAS in 2013 (70 Round)), the farmers income from various sources about 52% of the agricultural households in the country were estimated to be indebted. Share of income of agriculture household from non-farm business in their average monthly income decreased with increase in land possession.

## Conclusion

Based on Dalwai Committee Report, Govt. of India started several initiatives in order to doubling the income of farmers through programs and schemes. Reforms in the area of marketing, soil health, insurance, water management etc.

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# Carbon Markets and Financial Mechanism for Sustainable Agriculture - Towards Net Zero Emissions

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*India is the world's fourth-biggest emitter of carbon dioxide after China, the US and the EU. According to the FAO, agriculture, forestry, and other land-use practices account for 24% of global greenhouse gas emissions and agriculture alone accounts for 34% of global GHG emissions. In order to minimise GHG emissions from various sectors in general and agriculture in particular, various mechanisms are advocated by national and international organisations, among them carbon market is rapidly growing and engrossing the attention of development stakeholders. The carbon market is expected to grow by 10 - 40 billion dollars in 2030 with a higher carbon price. Several countries, including India, are committed to moving towards a net-zero emissions economy and adapting to low low-carbon paths to economic growth and development. To achieve this, many Sustainable Agricultural Practices (SAPs) are promoted at farmer levels. Therefore, to understand various SAPs and the growing carbon market, the International Webinar on Carbon Finance for Agriculture towards Climate Risk Mitigation was organized on 20 January 2022 by the National Institute of Agricultural Extension Management (MANAGE). This article vividly discusses the major outcomes of the Webinar related to prevailing SAPs to minimise the GHG emission as well as various carbon financial mechanisms promoted globally.*

**Keywords:** Climate Change, Carbon Credit, Carbon Market, GHGs, Carbon Financing, Sustainable Agriculture, Net-Zero Emission

## 1. Introduction

Climate Change is a global threat. The increasing concentration of Green House Gases (GHGs) in the atmosphere is becoming a serious concern, which demands an urgent global response (Leitmann, n.d; Sapkota and White, 2020), According to the FAO, agriculture, forestry, and other land-use practices account for 24% of global GHG emissions. By and large, the total global livestock emissions of 7.1 gigatons of $CO_2$ equivalent per year, contribute to 14.5% of total anthropogenic GHG emissions. According to the World Resources Institute Climate Analysis Indicators Tool (WRI CAIT), in 2014, India's total

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GHG emissions were 3,202 million metric tons of carbon dioxide equivalent (MtCO2e), totalling 6.55% of global GHG emissions. India is the world's fourth-biggest emitter of carbon dioxide after China, the US and the EU. The emission of GHG has become severe and about 50 countries have reached a carbon peak, accounting for about 36% of global carbon emissions. Agriculture and food production account for 34% of global greenhouse gas emissions. Thereby, it is one of the critical sectors in addressing GHG emissions and contributing towards net zero emission (Asher, 2021).

Carbon markets refer to placing a price on carbon measures which helps stimulate abatement and technology transfer and drive investment in low carbon technologies and services. The carbon market has come into being with the genesis of the United Nations Climate Change Convention (UNFCCC), 1992 with limited voluntary carbon sequestration pilot projects happening across the globe. The Kyoto Protocol in 1997 has slowly enabled stakeholders across the globe to fund and implement the decarbonisation projects on a larger scale.

Globally, two types of carbon markets exist and are exare growing rapidly, namely project-based carbon credits under the Clean Development Mechanism (CDM) i.e. compliance market (mandatory emission reductions driven by regulations) and the voluntary carbon market. The voluntary market is driven mainly by the private sector in the form of undertake several carbon offset projects (Gledhill, 2011; Sapkota and White, 2020). The value of the voluntary carbon market was estimated at 1 billion dollars in 2021 (Ecosystem Marketplace 2021) and according to Trove Research, 2021, it is expected to grow by 10- 40 billion dollars in 2030 with a higher carbon price. The growing carbon market credit can be attributed to increasing net zero commitment agreed by signatory countries of the Conference of Parties (COP) UNFCCC. It is expected that there will be a huge shift of demand drivers from compliance purpose to voluntary commitments by 2030 towards achieving net-zero commitments. To achieve net-zero emissions, developed countries have reduced the carbon intensity of their economies and developing countries have to adopt low carbon paths to economic growth and development (Leitmann, n.d). 137 countries, including India, committed to moving towards a net-zero emissions economy at COP26 held at Glasgow. Under this circumstance, this paper reviews the potentials of net zero agriculture, analyze the role of specific pathways of carbon markets and identify the challenges in upscaling available carbon financing options and mechanisms.

## 2. Materials and methods

The data related to sustainable agricultural practices have been collected through a literature review, also from presentations of the eight speakers, from both national and international organizations, who shared their experience on "International Webinar on 'Carbon Finance for Agriculture towards Climate Risk Mitigation", which was organised on 20$^{th}$ January 2022 by National Institute of Agricultural Extension Management

(MANAGE). Keywords used for collection of data were net-zero economy & carbon mitigation potentials in agriculture, distribution of carbon mitigation potential, five pathways in carbon farming, co-benefits of carbon farming, carbon market, carbon pricing clean development mechanism, carbon funds, challenges in carbon markets and financing sustainable agriculture, small-hold farms and corporate financing and governance considerations.

## 3. Net-Zero Economy and Carbon Mitigation Potentials in Agriculture Sector

Net-zero means that any emissions are balanced by absorbing an equivalent amount from the atmosphere. To meet the 1.5°C global warming target in the Paris Agreement, global carbon emissions have to reach net-zero by 2050 (Cran-McGreehin, n.d. and Ahmed *et al*, 2020). Many countries and business entities are making efforts to achieve net-zero emissions and the Paris Agreement's goals of keeping global warming well below 2°C, ideally below 1.5°C. If the world reaches net-zero emissions by 2040, there is a high chance of limiting the warming to 1.5 degrees C (Levin *et al*. 2019). Globally and locally, the public and private sectors are investing in cleaner and less emission-intensive energy systems in all sectors. Certainly, both international and national organizations will make effort to reduce the reliance on fossil fuels as two-thirds of electricity generation relies on fossil fuels and 95% of the energy consumed by the world's transport systems relies on fossil fuels (Gurría, 2013). Similarly, agricultural production is also the largest source of methane and nitrogen dioxide emissions due to enteric fermentation and the use of inputs such as water, fertilizers and pesticides, farm machinery, soil disturbance, residue management and irrigation for the production of crops and management of animals. Therefore, there is a need for efficient production practices and technologies to reduce the emission of GHGs from the agricultural sector (Prasad et al, 2021., Locke, 2021). Minimizing the agricultural greenhouse gas emissions is important, especially, reducing the emission of $CO_2$ methane and $N_2O$ is climatically beneficial and must be encouraged to meet the net zero-emission (Lynch *et al*. 2021). The sectors other than agriculture have evolved several emission reduction technologies. For example, in the electricity sector, coal and gas can be replaced with wind and solar energy (Ahmed *et al*, 2020). However, reducing agriculture emissions has to undergo a drastic change in how we farm, what we eat, how much we waste, and how we manage our forests and natural carbon sinks (Ahmed *et al*.2020).

Though there is no explicit emission reduction technology in the agricultural sector, there is a range of Good Agricultural Practices (GAPs) identified to reduce the emissions of GHG to a maximum extent. The carbon sequestration potential achieved due to the adoption of good agricultural practices have attracted the highest carbon credits in the carbon market. However, agriculture accounts for only 1% of all carbon credits transacted according to the Berkeley Carbon Trading Project. Conversely, forestry and other land use

pattern have generated about 45.8% of all transacted carbon credits (Ellis, 2021). Also, the carbon offset for the forestry sector is conspicuous and the carbon credits are traded under both compliance and voluntary. Therefore, promoting sustainable agricultural practices is essential as about 18% of total emissions from agriculture could be abated by adopting technically feasible mitigation measures (Sapkota et al, 2019; Sapkota and White, 2020).

**Table 1: Pathways in decarbonizing through agriculture.**

| Carbon farming pathways | Important practices |
|---|---|
| Improved agronomic practices | Use of cover crops, improved crop, fallow rotation, improved crop varieties use of legumes in crop rotation |
| Integrated Nutrient Management | Use of efficient nitrogen fertilizer, use of organic manure, legumes, green manure and compost from animal wastes |
| Tillage or reside management | Incorporation of residues, reduce or zero tillage |
| Water management | Proper irrigation management, bunds/Zai, terrace or contour farming, water harvesting structures such as runoff collection structures, water storage tank construction, devices for lifting and conveying water |
| Perennials and agroforestry | Live barriers or fences, uderswoing of Tephrosia, Vogelii; Piogen pea, Sesbania sesban in Maize for soil fertility improvement, dispersed tree interplanting (e.g. faidherbia, Acacia, polycantha, A.galpinii and contour grass hedges. Similarly, bamboo forest ecosystems can store between 94 and 392 tonnes of carbon per hectare (tC/ha) King et al, 2021. |

**Table 2: Agricultural Technologies and practices, GHGs reduction potential and challenges in large scale adaption**

| Name of the GHG emission reduction sustainable agricultural practices or technology | Farming practice or technology under Business as usual scenario | Mitigation potential $CO_2$ | Cost-saving per $tCO_2e$ (in dollar) | Present challenges in promotion/ adoption |
|---|---|---|---|---|
| Zero-emissions on-farm machinery and equipment | Tractors, harvesters, and dryers | ~537 $MtCO_2e$ | ~\$229/$tCO_2e$ | no notable commercial launches |
| Greenhouse gas–focused genetic selection and breeding | Low productive small ruminants | ~506 $MtCO_2e$ | - | Less investment in genetic selection and breeding |

| Name of the GHG emission reduction sustainable agricultural practices or technology | Farming practice or technology under Business as usual scenario | Mitigation potential $CO_2$ | Cost-saving per $tCO_2e$ (in dollar) | Present challenges in promotion/ adoption |
|---|---|---|---|---|
| Improved fertilization practices in rice cultivation | Present nitrogenous fertilizer application | ~449 $MtCO_2e$ | ~\$3/$tCO_2e$ | less adoption of 4 Sulfatecontaining fertilizers (such as ammonia sulfate) and sulfate amendments (such as gypsum) |
| Improved animal health monitoring and illness prevention | No proper attention to the management of livestock | ~411 $MtCO_2e$ | ~\$5/$tCO_2e$ | Less access to animal health products and clinical resources |
| Optimisation of animal feed mix | Less dry matter in feed | ~370 $MtCO_2e$ | ~\$131/$tCO_2e$ | Inadequate support to Product innovation, strategic marketing, and technical support from feed producers, distributors, and nutritional advisory networks. |
| Expand use of animal feed additives | No feed additives | ~299 $MtCO_2e$ | ~\$88/$tCO_2e$ | The majority of the farmers are not practising the confined feeding |
| Improved rice paddy water management such as Alternate wetting and drying, single-season drainage, and other methods | Farmers practice conventional flooding | ~296 $MtCO_2e$ | ~\$12/$tCO_2e$ | Regional rainfall patterns, field characteristics and existing payment and financing schemes are the major barriers |
| Use of anaerobic manure digestion | - | ~260 $MtCO_2e$ | ~\$92/$tCO_2e$ | |
| Use of feed-grain processing for improved digestibility | Direct feeding or free grazing | ~219 $MtCO_2e$ | ~\$3/$tCO_2e$ | Capital constraints |

| Name of the GHG emission reduction sustainable agricultural practices or technology | Farming practice or technology under Business as usual scenario | Mitigation potential $CO_2$ | Cost-saving per $tCO_2e$ (in dollar) | Present challenges in promotion/ adoption |
|---|---|---|---|---|
| Adoption of dry direct seeding in rice cultivation | Most of the farmers grow rice seedlings in a separate nursery and transplant them into flooded paddies. | ~217 $MtCO_2e$ | ~\$41/$tCO_2e$ | Rainfall patterns wet seasons determine the adoption. Also access to adoption of several incremental technologies (such as laser-land levelling), optimal rice varieties, precision water management and herbicides are essential to realising the impact. |
| Uptaking of technologies that increase livestock production efficiencies (hormones, microbial additives (for example, probiotics), biosecurity, herd management and monitoring (including new digital tools), and vaccination) | - | ~180 $MtCO_2e$ | ~\$119/$tCO_2e$ | There is a need for facilitating policy to encourage innovators and enterprises to focus on livestock production efficient technologies. |
| Use of nitrification inhibitors on pasture | Not widely practised by farmers | ~123 $MtCO_2e$ | ~\$15/$tCO_2e$ | - |
| Scale low- and no-tillage practices | Not many farmers have adopted | ~119 $MtCO_2e$ | ~\$41/$tCO_2e$ | - |
| Reduce nitrogen overapplication in China and India | Use of high nitrogenous fertilizer by farmers | ~88 $MtCO_2e$ | ~\$97/$tCO_2e$ | Due to subsidised Nitrogen fertilizers |
| Adoption of controlled-release and stabilized fertilizers | - | ~75 $MtCO_2e$ | \$65/$tCO_2e$ | Crops' nutrient requirements vary as they mature and may not be in linear |

*Ahmed et al. 2020 McKinsey & Company*

Promotion of Precision Nutrient Management Technologies (PNMTs), use of legumes for

long term, practising Zero Tillage (ZT), promoting micro irrigation systems, popularising laser levelling, minimise or stopping the reside burning, production of biogas at farmers level, large scale adoption of organic as well as natural farming, use of biochar, application of farmyard manure, adoption of agroforestry, use of solar energy for agricultural production, etc.

There are a number of carbon mitigation options in agriculture and they also have co-benefits to farmers. For example, managing peatlands reduce GHG emissions and the farmers can make use of these wetlands for growing crops. Such measure also contributes to increased biodiversity, flood regulation and improved water quality. Promotion of agroforestry in farmlands and wastelands help in the sequestration of carbon and this will further ensure improved water retention, improved soil health and enhance biodiversity and guarantees, farmers, a minimum income against the failure of any single crop. Likewise, improved crop, grassland, fertilizer and livestock management will minimize the emission of GHG and enhance the soil water retentions, reducing the nutrient runoff and ammonia emissions. There is also a need for awareness programmes for extension professionals about the benefits and co-benefits of carbon mitigation practices. This will enable them to disseminate the information of co-benefits of such good practices to farmers, thereby helping farmers to try them in their farmlands and contribute to the reduction of GHG emissions. However, there are inadequate methods to assess the carbon sequestration potential of these good agricultural practices at the farmers' level. Therefore, the public sector and government have to work with international organisations to develop methodologies to assess the carbon sequestration at the farmers' level, which will further enable the stakeholders to quantify the potential of carbon sequestration.

## 4. Specific pathway considerations and contributions of carbon markets

### 4.1 Carbon pricing

According to the World Bank, carbon pricing is an instrument that captures the external costs of greenhouse gas (GHG) emissions—the costs of emissions that the public pays for, such as damage to crops, health care costs from heatwaves and droughts, and loss of property from flooding and sea-level rise and ties them to their sources through a price, usually in the form of a price on the carbon dioxide ($CO_2$) emitted. There are different types of carbon pricing namely Emissions Trading System (ETS), carbon tax, offset mechanism, RBCF and Internal carbon pricing. The selection of carbon pricing type varies from country to country and city to city based on national circumstances and political situations

Carbon pricing is still the preferred policy option for sustainable climate policy (Ewing, 2018). It creates a financial incentive to mitigate emissions of GHG through appropriate pricing mechanisms. By incorporating climate change costs into economic decision-

making, carbon pricing can help encourage changes in production and consumption patterns, thereby helping to achieve low-carbon growth. Carbon credit markets are continued to grow. In 2021, 21.5% of global GHG emissions are covered by carbon pricing instruments in operation, it was higher than the year 2020 when only 15.1% of global emissions were covered (World Bank, 2021). Carbon pricing mechanisms are grouped into three categories namely (i) cap-and-trade (i.e. emissions trading systems (ETS)), (ii) carbon taxation and/or (iii) hybrid mechanisms that combine elements of both.

Carbon pricing curbs greenhouse gas emissions by placing a fee on emitting and/or offering an incentive for emitting less. The price signal created shifts in consumption and investment patterns, making economic development compatible with climate protection. The carbon emission reduction effects will gradually increase with the carbon price (Liu *et al,* 2018). Further, it plays a pivotal role in realizing the ambitions of the Paris Agreement and implementing the Nationally Determined Contributions (NDCs). As of 2017, 42 countries and 25 subnational jurisdictions (cities, states and regions), already have carbon pricing initiatives.

**Table 3: Major Types of carbon pricing schemes and their characteristics**

| Types of Carbon pricing | Remarks |
|---|---|
| emissions trading system (ETS) | It is a system where emitters can trade emission units to meet their emission targets. To comply with their emission targets at least cost, regulated entities can either implement internal abatement measures or acquire emission units in the carbon market, depending on the relative costs of these options |
| Carbon Tax | It directly sets a price on carbon by defining an explicit tax rate on GHG emissions or—more commonly—on the carbon content of fossil fuels, i.e. a price per tCO2e. It is different from an ETS in that the emission reduction outcome of a carbon tax is not pre-defined but the carbon price is. |
| Carbon Offset Mechanism | It designates the GHG emission reductions from project- or program-based activities, which can be sold either domestically or in other countries. Offset programs issue carbon credits according to an accounting protocol and have their own registry. These credits can be used to meet compliance under an international agreement, domestic policies or corporate citizenship objectives related to GHG mitigation. |

| | |
|---|---|
| Result Based Climate Finance (RBCF) payments | It is a funding approach where payments are made after pre-defined outputs or outcomes related to managing climate change, such as emission reductions, are delivered and verified. Many RBCF programs aim to purchase verified reductions in GHG emissions while at the same time reducing poverty, improving access to clean energy and offering health and community benefits. |
| Internal carbon pricing | It is a tool an organization uses internally to guide its decision-making process concerning climate change impacts, risks and opportunities. |

There are other international carbon pricing initiatives of the United Nations Framework Convention on Climate Change (UNFCCC) namely Clean Development Mechanism (CDM), Joint Implementation (JI) and Emissions trading (ET). The Joint Implementation (JI) and Clean Development Mechanism (CDM) are offset mechanisms under the Kyoto Protocol under which entities from industrialised countries (Annex I countries) could participate in low-carbon projects in host countries and obtain credits in return. International Emissions Trading (IET) is an international ETS set up to allow Annex I countries to achieve emission reductions at least cost. These three carbon pricing mechanisms are significant in the creation of cross-boundary carbon markets.

There is an increasing trend of using internal carbon pricing. For example, Corporate applications support corporate strategic investment decision making and help companies shift to lower-carbon business, Some governments are using internal carbon pricing as a tool in their procurement process, project appraisals and policy design about climate change impacts and Financial institutions have also begun using internal carbon pricing to assess their project portfolio. China has launched China's national emissions trading system (ETS) and it is considered to be the world's largest carbon market. Crediting mechanisms create tradable credits from voluntarily implemented emission reduction or removal activities (World Bank, 2021).

## 4.2 Clean Development Mechanism (CDM)

Kyoto Protocol (1997) is very important in addressing the climate change challenges by introducing three innovative mitigation mechanisms namely Clean Development Mechanism (CDM), Joint Implementation (JI) and **Emissions Trading (ET)**. One of these mechanisms is the Clean Development Management (CDM) and it is one of the most important carbon market instruments. CDM represents today the largest GHG emission offsetting scheme in the world. CDM allows converting 100% of the achieved GHG reduction into tradable units (certified emission reductions, CER) which are normally used to emit the same amount of GHG elsewhere (Warnecke et al, 2015). It is the first global, environmental investment and credit scheme of its kind, providing standardized emissions offset instrument, Certified Emission Reductions (CERs).

The CDM is harnessing the power of markets and the private sector to meet goals on sustainable development and climate change and for financing in support of the 2030 Agenda for Sustainable Development and the Paris Agreement. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers.

Clean Development Mechanism (CDM) has allowed industrialized countries to buy credits by investing in greenhouse gas (GHG) emission reduction projects in developing countries, which contribute to sustainable development in the host countries to meet targets under the Kyoto Protocol (Erickson et al, 2014 and Huang and Barker, 2004). There are several CDM projects implemented by many countries to lead to significant emission reductions that will help reduce the cost of climate mitigation in countries with commitments as well as contribute to sustainable development in the host countries (Hultman *et al,* 2021). China, India, Mexico, Brazil and Korea have attracted high investment on CDM projects and China and India are by and large China and India are the topmost countries in the implementation of CDM projects across the globe. The share of CDM projects of China, India, South Korea, Vietnam, Indonesia, Malaysia, Thailand Pakistan, Sri Lanka and other countries is 70.8%, 18.5%, 2.5%, 1.9%, 1.8%, 1%, 0.8%, 0.6%, 0.4% and 1.7%., respectively. Most of the CDM projects are in the generation of energy from agricultural wastes (159 projects), livestock management (139 projects), energy from the woody sector (40 projects) and Afforestation and Reforestation (A/R) Projects (01 projects). Though India has gradually moved towards a carbon positive in the last 10 years, in Asia, most of the Clean Development Mechanism (CDM) projects are implemented by China and it has 70.8% projects related to CDM in agriculture, followed by India (18.5%).

**Box 1. World's largest CDM project in Himachal Pradesh**

In Himachal Pradesh, world's largest and India's first clean development mechanism (CDM) project registered for carbon credits by the United Nations. World Bank will buy carbon credits from the new forests /plantations which are planted on degraded areas in 177 Gram Panchayats covering around 4000 hactare land falling in 10 districts of the state. This project may cover 4,003.07 hectares and the expected sequester the emission of 8,00,000 tonnes of carbon dioxide from 2006 to 2025 by promoting bio diversity through native species in remote areas, thus contributing to the fight against global warming. The project has improved productivity and raised the living standard of rural households.

*Source: The News Himachal, 2011*

Of the CDM's projects, about 72 per cent are in the renewables sector, with the wind (31 per cent) and hydro (26 per cent) accounting for the major share. The CDM has further contributed to establishing robust standards and methodologies to quantify and monitor emission reduction projects (UNFCC, 2018). In agriculture, watershed restoration through A/R activities, or indirectly through integrated farm energy systems/energy efficiency activities, agroforestry systems, integrated farm energy system through the production of biomass residue, renewable biomass, and plant oil for biodiesel production, livestock management etc., etc., are a few methodologies of CDM to quantify and monitor emission reductions (Gledhill, 2011). Kachung Central Forest Reserve afforestation project, Uganda was led by Green Resources, a company that specialised in forestry and renewable energy. The planting of trees was undertaken on 2,050 hectares of 'degraded' grass and shrubland in Kachung Central Forest Reserve. This project is recognised as a Clean Development Mechanism (CDM) project, and was validated under the Climate Community and Biodiversity Standard (CCBS) in 2011. Approximately 33 million USD was provided to Green Resources by Norfund, FMO and Finnfund, Carbon (Market Watch, 2018).

According to the Secretariat, UNFCC (2018) report, there were around 7,847 CDM projects were registered as of April 2022. Also, 140 countries are involved in implementation of CDM projects with five regional collaboration centres, 216 baseline and monitoring methodologies and 39 standardized baselines in 15 sectoral scopes and 700 CDM consulting firms and countless with a number of CDM experts worldwide. It was estimated that 2 million tonnes of Carbon Dioxide equivalent (CO2e) were reduced in the developing world due to CDM projects. Around 303.8 billion USD was invested in climate and sustainable projects and 200 million were contributed to the adaptation fund. Further, under the CDM projects, 152 million trees were planted worldwide. It was also estimated that 40 per cent of CDM projects are implemented with the local community leading to jobs, education and improved living conditions. Around 8,40,000 people were provided with clean drinking water. Many research reports that there is a significant impact on emission reduction of $CO_2$ from CDM projects. The potential impact of the CDM application on the regional energy-water-carbon nexus optimization in electric power systems in China illustrate that CDM will play an important role in the regional energy-water-carbon nexus optimization. It has a major impact on power generation and capacity expansion path, system cost control, CO2 emissions abatement, water consumption and wastewater discharge (Tan et al, 2020). Further, in China, about 11% of hydropower and 93% of wind power was generated by CDM projects in 2010 (Sun, 2011). Similarly, solar power projects under CDM are playing an important role in technical, economic, social, environmental, and risk mitigation (Simsek *et al*, 2018). Similarly, CDMs can contribute to reducing the emission of GHGs from cities as they consume 80 per cent of the world's energy and account for over half of global carbon dioxide emissions. The case of the CDM of Transmilenio bus rapid transit system in the Colombian capital Bogotá, home

to 8 million people illustrates that it has avoided 2.4 million tonnes of $CO_2$ equivalent (S, UNFCC, 2018).

## 4.3 Carbon funds

Carbon finance has drawn considerable attention in recent years since it can promote low-cost emission reductions (Zhou and Li, 2019). Several organizations fund the projects and programmes to help in addressing the climate change risks. Both public and private organisations from national and international provide climate finance for promoting sustainable agriculture practices. Also, Corporates, commercial Finance Institutes, philanthropists finance sustainable agriculture. Further, the Carbon Finance Unit of the World Bank is administering several carbon funds including Community Development Carbon Fund to reduce poverty, mitigate climate change and promote Corporate Social Responsibility (CSR). The World Bank's carbon finance initiatives have supported activities in 65 countries and have made $2 billion in Emission Reduction payments since the first carbon fund (Prototype Carbon Fund) was launched in 1999. A few of the carbon funding mechanisms of the World Bank as given in the below Table 4.

**Table 4: Evolving Carbon funding options**

| Name of the Carbon fund | Remarks |
|---|---|
| Forest Carbon Partnership Facility (FCPF) | It supports REDD+ efforts through its Readiness and Carbon Funds. It is implemented in Chile, Costa Rica, Côte d'Ivoire, the Democratic Republic of Congo, Ghana, Indonesia, Mozambique, Vietnam. These will unlock over $450 million for efforts to lower carbon emissions from deforestation and forest degradation through 2025. |
| Green Climate Fund (GCF) | It is a critical element of the historic Paris Agreement - is the world's largest climate fund, mandated to support developing countries raise and realize their Nationally Determined Contributions (NDC) ambitions towards low-emissions, climate-resilient pathways. |
| Climate Emissions Reduction Facility (CERF) | It is an umbrella fund for climate finance and it is the Bank's first trust fund providing operational liquidity at scale for low-carbon development projects. |
| Canada-World Bank Clean Energy and Forests Climate Facility | It to help accelerate the clean energy transition in Asia and small island developing states as well as boost support for forests and sustainable land use. |

| | |
|---|---|
| Climate Investment Funds | One of the world's largest and most ambitious multilateral climate finance mechanisms for developing countries seeking to shift to low carbon and climate resilient development, and to accelerate climate action.<br>It is a premier source of global climate finance and it has set a $5 billion fundraising target for new investment programs in key impact areas. |
| Compact-with-Africa Green Businesses multi-donor trust fund | To boost green businesses in Africa |

World Bank, 2020

Also, Conservation International's Carbon Fund invests in sustainable landscapes that help combat climate change by reducing deforestation and conserving critical ecosystem services by Conservation International. BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL) to ensure Sustainable Forest Landscapes (ISFL) collaborates with countries around the world to reduce emissions from the land sector through smarter land-use planning, policies, and practices. Also, ADB has invested around 7.6 billion dollars as Climate Investment Funds which include Clean Technology Fund (5.2 billion dollars), a Pilot programme for climate resilience (1.3 billion dollars), a Forest investment programme (639 million dollars) and scaling up renewable energy in low-income countries program (524 million dollars). Also, in India NABARD plays a major role in financing climate smart projects. NABARD is providing the Adaptation Fund (AF) and Green Climate Funds to encourage the stakeholders to implement the projects related to sustainable agriculture. Most of the funds are spent in the following areas namely agriculture, forestry, biodiversity, livelihoods etc. Also, a portion of funds is allocated for improving the livelihoods of tribal areas.

**Table 5: NABARD's role in promoting sustainable agriculture**

| Name of the Initiative | Budget allotted (in Rs) | Impact |
|---|---|---|
| Tribal Development Fund (2003 to 04) | Around Rs. 2378.00 crores were sanctioned and Rs. 1688.00 crores disbursed. | A total of 835 projects were sanctioned in 29 states on 0.5 million acres of land. A total of 27 million trees were planted. Around 5.64 lakh families were covered. The carbon sequestration potential of these initiatives was estimated to be 56.8 million tons of CO2 per year. |

| | | |
|---|---|---|
| Umbrella Programme on Natural Resource Management (UPNRM) | Around Rs. 784.00 crore Sanctioned and Rs. 577.20 crores disbursed. | A total of projects 334 projects were sanctioned in states on around 0.5 million acres of land. 3.32 lakh families. |
| Watershed Development | An amount of Rs. 2390 crores have been sanctioned and Rs. 1902 crores were released. | A total of 3401 watershed projects cover an area of 23.4 lakh ha. |
| ProSoil: Soil Protection and Rehabilitation for Food Security (2019-2023) | An amount of Rs. 82.71 crores was sanctioned for the project | A total of 1,53,000 hectares of degraded soil rejuvenated under this project in the states of Maharashtra and Madhya Pradesh. A total of 13,900 households were benefited so far. There is also a marked increase in yield by 28% in rice and a considerable increase in yield of pigeon pea and wheat crops. |

Most of the funding support is coming from international donors of both public and private and also from domestic agencies. Currently, 30% of agricultural finance in developing countries comes from public sector sources. However, there is a need for increasing the private sector investment (Gledhill *et al,* 2011). Investment from the international funding agency and public sector, coupled with the private sector investment will help farmers to adopt the internationally accepted good agricultural practices on a larger scale.

## 5. Challenges in Upscaling the Carbon Markets and Financing Schemes for Net -Zero Agriculture

Current policies, institutions, and governance mechanisms cannot successfully channel the large private investments in AFOLU and food systems that are required to transform the sector from a major emitter to a major greenhouse gas sink. The innovations in policy, governance, and institutions (Arndt, 2021), coupled with private sector investment is critical to accelerate progress on climate change and fund the clean development mechanism in Agriculture (World Bank, 2020).

Sovacool (2011) identified four major problems global carbon markets and trading namely homogeneity, justice, gaming, and information. Homogeneity problems arise from the non-linear nature of climate change and sensitivity of emissions, this hampers the attempts to calculate carbon offsets. Justice problems involve issues of dependency

and the concentration of wealth among the rich, meaning carbon trading often counteracts attempts to reduce poverty. Gaming problems include pressures to promote high-volume, least-cost projects and the consequences of emissions leakage. Information problems encompass transaction costs related to carbon trading and market participation and the comparatively weak institutional capacity of project evaluators.

## 5.1 Small Scale Farming and Landholder

Farmer level challenges such as small land holding pose a major challenge. I.e. farms less than 2 hectares account for about 75 per cent of farms globally (Ahmed et al, 2020) and in India, 86.08 per cent of the farmers are having small and marginal holdings (less than 2 hectares). The all- India average size of holding is 1.08 ha (GoI, 2020). Further, there are inadequate methods to measure the mitigation potential of sustainable agricultural practices at the individual farmer level (i.e. smallholder farmers). Apart from Small-holdings, there are a number of factors that prevent the farming community to adopt carbon farming initiatives (CFI) or sustainable agricultural practices. Farmers also lack skills or management abilities in new sustainable agriculture practices. Similarly, a lack of access to information regarding available technology options for sustainable agriculture undermines the farmers' adoption process. Further, instability in carbon prices, uncertainty regarding benefits from carbon farming, difficulty in monitoring the progress of such initiatives, uncertainty regarding carbon market selling practices, and the financial consequences of participation. Farmers also stated that the sale of products from tree plantations is difficult, indicating their reluctance to implement carbon farming as they consider it to be dissenting from other objectives. Further, to achieve the scale, billions of farmers have to change their behaviour, including reducing ruminant animal protein (mostly beef and lamb) consumption and food waste (Ahmed *et al*, 2020).

Further, the challenges to low carbon financing of agricultural projects can be grouped into four major headings. Policy level: Changing policies and complex procedures are the major barriers. Inadequate carbon market mechanism. However, most of the countries are evolving carbon market mechanisms. India can study and adopt the suitable carbon market mechanism to the Indian situation to utilize the highest carbon price potential scenario, which is followed by institutional-level challenges such as high initial investment cost, longer recovery periods, high collateral requirement, insufficient credit and maturity, lack of capacity to value assets are detriments of carbon financing the agricultural projects. similarly, market challenges such as currency risk, insufficient profits, unpredictable cash flow, non-favourable & rising interest rates, technology advancement risks and unstable consumer market.

## 5.2 Corporate Financing

Investment is key to any economic activity. Across the globe, corporates through their

Corporate Social Responsibility (CSR) has been contributing to the development of the economy by enhancing the livelihood of the people. In agriculture as well, capital is necessary for timely application of inputs, undertaking timely field operations, increasing productivity and realising a better price for farm produce. In India, farmers face various problems related to inputs, credit, advisory services and infrastructure due to poor investment in agriculture. Hence, there is a need to promote investment in this sector, which can be accomplished through CSR. According to CSRBOX and NGOBOX, (2020), the major thematic areas covered under the CSR fund are Education & Skills and Poverty Alleviation, Healthcare, Water, Hygiene and Sanitation and Rural Development. Around 70% of the CSR fund is spent on the above sectors. Hence, there is a need for channelizing the CSR funds towards the development of sustainable agricultural practices, thereby paving a way for enhanced carbon sequestration and reduced GHG emission from the agricultural sector. Additionally, the CSR forum established by the National Institute of Agricultural Extension Management (MANAGE) can serve as an important platform for the different corporates to come together and share their experiences, knowledge, innovations and technologies relating to sustainable agricultural practices and implement them through effective partnership and collaboration between corporates and public sectors for integrated delivery of farm service. Therefore, there is a scope for utilizing the innovation and financial strength of corporates towards funding the projects and programmes related to sustainable agriculture.

## 5.3 Governance considerations

The end of the year 2020 marks a fundamental change in the global governance of greenhouse gas (GHG) emissions. The new context of the Paris Agreement has important implications for the voluntary carbon market, i.e. the voluntary purchasing and retiring of carbon credits. Historically, carbon credits have mostly been generated from projects implemented in countries that did not have GHG emissions targets under the Kyoto Protocol. In this context, the carbon credit's emission reductions were only used by the buyer to achieve a climate change mitigation target or goal, and not by the country hosting the mitigation project. Under the Paris Agreement, however, all countries must formulate climate targets or actions in the form of nationally determined contributions (NDCs). In this context, the developing including India has ratified the Paris agreement to achieve net-zero emission by 2070 by Reaching a non-fossil fuel energy capacity of 500 GW by 2030; fulfilling 50 per cent energy requirements via renewable energy by 2030; reducing CO2 emissions by 1 million tons by 2030, and reducing carbon intensity below 45 per cent by 2030. In Agriculture as well, the government is making effort to promote natural farming on a mass scale to make agriculture sustainable and to contribute to decarbonizing the economy, in addition to the several GAPs.

Though there are policy, institutional, market and farmer level challenges, there are ample

opportunities to climate finance for the adoption of sustainable agriculture to reduce the GHG emissions and enhance the carbon credits from the agricultural sector. Further, there is a need for promoting CDM projects in agriculture to incentivize the farmers to adopt good agricultural practices.

However, the large scale promotion of sustainable agriculture practices and CDM projects in agriculture may not be possible without the enabling policy environment, mass-scale awareness and capacity building programmes for stakeholders at different levels, evolving and utilizing internationally accepted standardized methodology/framework for assessing the carbon sequestration of sustainable agricultural practices, mobilising funds from private sectors and donor agencies, aligning the schemes and programmes of sustainable agriculture with carbon finance-related projects, Facilitating the adoption of sustainable agriculture practices at scale by a larger number of farmers and linking them to carbon trade. Further, the adoption of these technologies has to be achieved alongside ensuring food security and without limiting farmers' autonomy. This will help countries including India fulfil their compliances towards meeting their net-zero emission commitment within the specified year.

## 6. Summary

Agriculture sector has the potential to reduce GHGs emissions. About 18% of total emissions from agriculture could be abated by adopting technically feasible mitigation measures such as improved agronomic practices, improved fertilization practices in rice cultivation, integrated nutrient management, water management, perennials and agroforestry, improved animal health monitoring and illness prevention etc. Among the carbon pricing initiatives, Clean Development Mechanism (CDM) is emerging as one of the major climate offset measures. CDM represents today the largest GHG emission offsetting scheme in the world. Though about 72 per cent are in the renewables sector, with the wind (31 per cent) and hydro (26 per cent) accounting for the major share, there is enormous potential for promoting CDM projects in the agricultural sector. There are established standards and methodologies to quantify and monitor emission reduction projects in the agricultural sector such as watershed restoration through A/R activities, agroforestry systems, integrated farm energy etc. Also, the present CDM projects in agriculture and forestry such as forests /plantations CDM projects in Himachal Pradesh and Kachung Central Forest Reserve afforestation project illustrate that CDM projects can effectively be promoted in these sectors, in addition to renewable. Ther are a number of carbon funding options such as Forest Carbon Partnership Facility (FCPF), Green Climate Fund (GCF), Climate Emissions Reduction Facility (CERF), Climate Investment Funds etc. Hence, the extenson advisory service stakeholders have to make use of the emerging funding sources to get the CDM projects in agriculture and contribute towards achieving the net-zero emission commitment of Government by 2070. However, the challenges such

as small landholdings, initial investment cost, longer recovery periods, high collateral requirement, insufficient credit, uncertainty regarding benefits from carbon farming, difficulty in monitoring etc. are impeding the promotion of CDM projects in agriculture. Hence, evolving suitable working model such as community approach, Public Private Partnership, leveraging CSR funds, establishing linkages with carbon trading company etc., may help in overcoming challenges and promote sustainable agricultural practices as CDM.

## 7. Conclusion

Considering the role of sustainable agriculture in carbon sequestration and GHG emission reduction potential towards Net-Zero Emission, in addition to the present policy frameworks and programme support, the public and private sectors have to prioritise their extension teaching, training, education, research for the promotion of carbon mitigation in agriculture. There is also a need for more investment in the promotion of potential carbon sequestration and GHG emission reduction technologies and practices in agriculture, creation of technical manpower, identification of potential clusters/farmers (millions of farmers), establishment of partnership and collaboration with national and international organizations which are presently playing a major role in funding carbon offset projects. Further, extension functionaries have to be senistisised on carbon financing, carbon market, sustainable agricultural practices, clean development mechanism, funding provisions for carbon projects, etc., though regular training and capacity development programmes.

Thus, the appropriate policy frameworks, sensitization of extension functionaries, linkages and investment will further help the grassroots level organizations to facilitate the adoption of sustainable agriculture practices at scale. This will enable a greater number of farmers to get the benefits of carbon credits by establishing a link with carbon market and trade. This will further help industries to fulfil their compliances and countries to meet their net-zero emission, enhance productivity, increase the income of the farmers.

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# An Analysis of Agri-Ventures under Agri-Clinics and Agri-Business Centres (AC&ABC) Scheme in Uttar Pradesh State of India

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**ABSTRACT**

*The agriculture sector in India plays a pivotal role in the country economy through its substantial contribution to the country GDP. Agriculture and its allied sectors were the key sources of livelihood for around 70% of the population in India. Sustainability in agriculture could be achieved through Agripreneurship. Value-added agriculture and market-oriented farming through proper strategy and planning could ensure self-reliance and self-sufficiency. It could provide more employment, income, profit, food security and enable reverse migration from urban to rural by facilitating employment opportunities and empowering the rural economy. Agri-Clinics and Agri-Business Centres (AC&ABC) Scheme was introduced in 2002 by the Ministry of Agriculture and Farmers' Welfare in association with NABARD, aiming to promote the establishment of Agri clinics and agri business centers across India.*

*The study objective is to know about the diversity of agriventures established in Uttar Pradesh state and its impact. It also analyzes the challenges faced by agripreneurs and measures taken to overcome them. A total of 130 samples was collected among candidates who established ventures spread across Uttar Pradesh state. Rank Based Quotient had been conducted to know the constraints faced by agripreneurs. Result follows that representation of vulnerable sections was low. Furthermore, constraints concerning finance and a lack of entrepreneurial knowledge and skills were observed. Meanwhile, the scheme had helped generate employment, cover more farmers, and double the income of agripreneurs.*

**Keywords:** Agri-Clinics and Agri Business Centres (AC&ABC) Scheme, Agriventures, Agripreneurship, Utter Pradesh, India.

## 1. Introduction

Agribusiness and Agripreneurship have gained momentum globally in recent years. The World Bank supports agribusiness entrepreneurship programs in Tanzania and Nepal.

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In China, US-based global corporation Cargill, works closely with Coca-Cola and the World Wildlife Fund and had initiated various Agri-ventures by imparting training to small scale farmers to improve their income. Agripreneurship is a term used to refer to entrepreneurship in agriculture. Entrepreneurship refers to setting up a business, organizing, managing, and assuming the risks associated with the company. Or, in simpler terms, an entrepreneur, if they succeed in overcoming the various dangers, can create incremental wealth through income diversification. Agripreneurship is defined as "generally, sustainable, community-oriented, directly-marketed agriculture. Sustainable agriculture denotes a holistic, systems-oriented approach to farming that focuses on the interrelationships of social, economic, and environmental processes''.

Likewise, India also promoting Agripreneurship. India is home to twenty agro-climatic regions. Forty-six different types of soil are spread across the country along with the diverse flora and fauna. In the past decade, there has been a push in crop diversification towards plantation crops, horticulture, and allied activities. Problems of disguised unemployment and under-employment have inundated the country. Hence, agripreneurship will be an apt solution to tackle the fore-mentioned problems by providing viable business opportunities, which would generate employment. Agripreneurship has also been found to be necessary for ameliorating production and productivity. Predominantly, three factors influence agripreneurship in our country- economic condition, education, and culture. Agripreneurship, thus, has a significant potential for contributing towards a wide range of socio-economic development, including employment generation, poverty reduction, improvement in well-being, health and nutrition, and a reduction in rural-urban migration. There is a plethora of possible opportunities across various areas of agriculture. With the help of agripreneurship, non-profitable farming activities could be made profitable.

Low crop prices, along with many other factors, have resulted in the non-profitability of the farming sector. According to a study by OECD, since the last two decades, the farming sector in India had not generated adequate revenues for farmers to earn profits. As a result, 40 per cent of the farmers want to quit agriculture if alternative employment opportunities were made available, according to the National Sample Survey Office survey in 2018 on farmer's assessment. In such a situation, retaining farmers and youth in agriculture is a daunting task before the respective governments.

Research studies suggest that a shift from agriculture to agribusiness will prove beneficial by changing agriculture in India to cope with the challenges. The primary reason for the un-viability and non-profitability of the agriculture sector is the existence of risk factors, disguised unemployment, and structural issues of the industry such as landholding patterns, cropping patterns, irrigation patterns, traditional practices of value addition and marketing, etc.

In agripreneurship, it is collectivizing fragmented land, human resources, and other inputs. It also helps the farmers to be averse to the risk factors in agriculture. It increases competitiveness by enabling skills in value addition, management of enterprises, marketing the final product, and making it profitable. The vital components of agribusiness and sustainable agriculture include training and skill enhancement for adopting modern agricultural practices, strengthened supply chains for value-added products, new marketing techniques using the latest technologies and digital platforms, and updated agripreneurship policies. In India, both the Central and State Governments have formulated growth and development policies that encourage entrepreneurship and self-employment.

To supplement efforts of public extension by necessarily providing extension and other services to the farmers on payment basis or free of cost as per the business model of Agripreneur, local needs and affordability of target group of farmers as the main objective, Govt. of India launched Agri-Clinic and Agribusiness Centres (AC&ABC) in 2002 to attract youth into the agriculture sector.

## 1.2 Agriclinics and Agribusiness Centres Scheme

Agri-Clinics and Agri-Business Centres Scheme, often abbreviated as AC&ABC Scheme, was introduced in 2002 by the Ministry of Agriculture and Farmers' Welfare in association with NABARD, aiming to promote the establishment of Agri clinic and agribusiness centres all over the country. The scheme is implemented by the National Institute of Agricultural Extension Management (MANAGE), Hyderabad.

The objective of the scheme is to supplement the efforts of public extension by necessarily providing extension and other services to the farmers on a payment basis or free of cost as per the business model of Agripreneur, local needs and affordability of target group of farmers. To support agricultural development and to create gainful self-employment opportunities for unemployed agricultural graduates, agricultural Diploma holders, Intermediate in agriculture and biological science graduates with PG in agri-related Courses.

Agri-Business Centres are commercial units of agri-ventures established by trained agriculture professionals. Such ventures may include maintenance and custom hiring of farm equipment, sale of inputs and other services in agriculture and allied areas, including post-harvest management and market linkages for income generation and entrepreneurship development. The Agri-Clinics and Agri-Business Centres (ACABC) training programs run in all the states and Union territories of India through selected Nodal Training Institutes (NTIs) under private and government organizations. Training provides expert advice and services to farmers on various aspects to enhance the productivity of crops/ animals and increase farmers incomes.

Based on the eligibility criteria, candidates are identified and provided training for 45 days (earlier, it was 60 days). The training program curriculum includes marketing skills and finance management in entrepreneurship. It also provides support in Detailed Project Report preparation (DPR) and certificates after completing the program. Whoever got the certificate will be eligible to get personal loans followed by a credit-linked subsidy sanctioned by NABARD for establishing their agri-ventures. The scheme also provides refresher training programs on particular themes every year free of cost. Against this backdrop, the fundamental objective of the study is to ascertain the impact of agriventures established under the AC&ABC Scheme on the lives of agripreneurs in Uttar Pradesh and how it had contributed to the socio-economic development of stakeholders The study aims at investigating how the AC&ABC scheme changed the socio-economic development of the selected beneficiaries in the study area. The primary objective of the study was to analyze the long-term impact of the scheme on the beneficiaries. The study's secondary objective was to understand the main obstacles that affect the operation of ventures and how they were being overcome. The overall objective of the study is as follows:

1. To analyze the socio-economic condition of the agripreneurs of the associated agrivnetures.
2. To document the different kinds of agriventures that were established by the agripreneurs.
3. To study the impact of extension support activities of the agripreneurs on the farming community.
4. To delineate the challenges faced by Agripreneurs in sustaining the venture.

## 2. Methodology

Agriculture continues to be the backbone of the economy of Uttar Pradesh state, with around 65% of the population being dependent on agricultural activities. The Agriculture Survey of 2011-12 revealed around 233.25 Lakh farmers in the state and 165.98 lac hectares (68.7%) land was used for cultivation. It is inevitable for a state like Uttar Pradesh to develop the economy of the agriculture sector for the development of the state. However, like all other agrarian sectors, the Uttar Pradesh agriculture sector and farmers also face the challenges we mentioned earlier. In 2016, 69 farmers/ cultivators and 115 agricultural labours died of suicide in Uttar Pradesh, as per 2018 NCRB Data (NCRB report, 2018). After Maharashtra, Uttar Pradesh has been the most significant number of training programs and success stories under the AC&ABC scheme. As of 2021, there were 32,428 Agri ventures established across India under AC&ABC. A total of 7997 agriventures, about 48%, had been found in Uttar Pradesh alone since the inception of the scheme in 2002.

The study focuses on Agripreneurs who received training and established agriventures under the AC&ABC scheme in Uttar Pradesh. A structured questionnaire was developed and different types of questions covering socio-demographic factors, economic factors, constraints faced by the Agripreneurs in running their ventures, competitive advantages, critical success factors, and suggestions to improve the scheme were included to assess the overall picture of the perceptions of the agripreneurs. The variables such as the increase of income, turnovers of the ventures, the standard of living, etc., of the beneficiaries, have been considered for analysis. The simple random sampling method has been used to identify the beneficiaries of the AC&ABC scheme to ensure that agripreneurs belonging to all age groups, social categories, and class divisions are equally represented. A total of 130 agripreneurs responded to the online survey using Google forms and telephonic interviews. Primary data was collected through the semi-structured telephonic interview and Google forms, while Secondary data was collected from the available MANAGE database. For analysis, simple averages and descriptive statistics have been employed. A Rank-Based Quotient has been used to know the constraints faced by the Agripreneurs who had established ventures.

Rank-based Quotients (RBQ's) had been worked out with the following formula-

$$RBQ = \sum Fi \frac{(n+1-1)*100}{N*n}$$

Where,

i= Ranks given to concerned statements

N= Number of students

n=Number of ranks

Fi=frequency of students for the $i^{th}$ rank

## 3. Results and Discussions

### 3.1. Socio-Demographic profile of the respondents

**Table 1: Socio-Demographic profile**

| S. No. | Parameter | Classification | Frequency (N-130) | Percentage |
|---|---|---|---|---|
| 1 | Age | 15-24 | 20 | 15.38 |
| | | 25-34 | 70 | 53.85 |
| | | 35-44 | 32 | 24.62 |
| | | 45-54 | 7 | 5.38 |
| | | >54 | 1 | 0.77 |
| | Sub-total | | 130 | 100 |

| S. No. | Parameter | Classification | Frequency (N-130) | Percentage |
|---|---|---|---|---|
| 2 | Gender | Male | 130 | 100 |
| | | Female | 0 | 0 |
| | Sub-total | | 130 | 100 |
| 3 | Education | Agri-Graduates | 127 | 97.69 |
| | | Ph.D. | 3 | 2.31 |
| | Sub-total | | 130 | 100 |
| 4 | Marital Status | Married | 88 | 67.69 |
| | | Unmarried | 41 | 31.54 |
| | | Divorced | 1 | 0.77 |
| | Sub-total | | 130 | 100 |
| 5 | Caste | General | 30 | 23.08 |
| | | OBC | 90 | 69.23 |
| | | SC | 10 | 7.69 |
| | | ST | 0 | 0.00 |
| | | Others | 0 | 0.00 |
| | Sub-total | | 130 | 100 |
| 6 | Poverty Category | APL | 111 | 85.38 |
| | | BPL | 19 | 14.62 |
| | Sub-total | | 130 | 100 |
| 7 | Average Family size | 6.55 | | |
| 8 | Family Occupation | Agriculture | 128 | 98.46 |
| | | Non-Agriculture | 02 | 1.54 |

Source: Primary data

More than half of the agripreneurs, about 54%, were in the 25 to 34 years age group. Close to 25% of the agripreneurs were in the 35 to 44 years age group. Together, it was seen that close to 75% of the agripreneurs were below 45 years of age, which indicates that most of the participants were young or middle-aged. More than 15% of the agripreneurs belonged to the 15 to 24 years age group. However, it should be remembered that the minimum age to join the AC&ABC program is 18 years. Persons aged 45 to 54 years comprised over 5%. The oldest agripreneur was 60 years old and was the only respondent aged more than 55 years. The age limit of the program is 18 to 60 years.

Another critical observation is that all the respondents were males. The total number of females trained under AC&ABC in the country was 6,221 out of 75,159. In other words,

only about 8% of the persons trained under the scheme were females at the national level. Meanwhile, 106 females of the total 6,221 were from Uttar Pradesh. That is, only 1.7% of the female trainees under the program were from Uttar Pradesh. The total number of trainees from Uttar Pradesh was 16,798, accounting for 22% of the trainees nationwide.

The total number of persons who established agriventures under the scheme was 32,073, of which only 1,913 were females, accounting for 6%. Uttar Pradesh contributed only 20 females compared to the state total of 7,954 persons who had established agriventures. There was limited participation of women despite providing higher subsidy of 44 % to them. This indicated that a higher subsidy rate alone was not enough to encourage female participation. Increasing awareness among females and instructing NTIs to focus on female participation are some measures that may be taken.

Education played a vital role in establishing and managing the ventures. Close to 98% of the candidates were agricultural graduates as the programme mandates that the participants hold an intermediate/diploma/graduation in agriculture or related domain. The remaining 2% had completed their Ph.D. Over 69% of the respondents were from other backward class (OBC) categories, followed by 23% from the general category. The remaining 8% were from the Scheduled Caste category.

Most of the program participants were from the OBC at the national level, constituting 38% of the total trainees. Trainees belonging to Scheduled Caste (SC) constituted 11% of the trainees, while persons from the Scheduled Tribe (ST) category accounted for less than 3% of the trainees. The remaining 48% were from other categories.

In Uttar Pradesh, of the 16,798 trainees, others constituted 36%, OBC constituted 53%, and SC constituted 10%. Only 24 trainees were from ST Category, accounting for a negligible 0.1% of the total trainees in the state. Of those who had established agriventures in the state, SC accounted for more than 9%, OBC accounted for 54%, and others constituted the remaining 36%. Only nine persons from the ST category had established agriventures in the state. This was why there were no respondents from the Scheduled Tribe category in the study.

Most of the participants, more than 85%, were above the poverty line, and the remaining, almost 15% of the agripreneurs were from below poverty line. Furthermore, more than 98% of the agripreneurs hailed from families where the primary occupation was agriculture. Only less than 2% were from non-agriculture backgrounds. Finally, the average family size of each respondent was 7.

## 3.2. Venture-wise distribution of the respondents

A total of 130 respondents spread over 38 districts across the state of Uttar Pradesh participated in the survey. Majority of the respondents were from Amroha (19), followed by Muzaffar Nagar (12), and Bulandshahar (10), and Meerut (10), Barabanki

(9), Shamli (6), Moradabad (5), and Rampur (5), Lalitpur (4), Hardoi (4), Aligarh (3), Bareilly (3), Lakhimpur Kheri (3), Pilibhit (3), Saharanpur (3) also had more than two respondents each. The remaining respondents were from Ambedkarnagar, Amethi, Auraiya, Ayodhya, Chitrakoot, Etawah, Fatehpur, Gonda, Hamirpur, Hapur, Haridwar, Jalaun, Jhansi, Kaushambi, Lucknow, Mirzapur, Prayag Raj, Rai Bareli, and Shrawasthi (Annexure-1, Table.11).

**Table 2: Venture-wise distribution of the respondents**

| S. No. | Name of ventures | Sample (N-130) | Percentage |
|---|---|---|---|
| 1 | Agri-clinics | 3 | 2.31 |
| 2 | Agri-clinics & Agri Business Centers | 61 | 46.92 |
| 3 | Bee Keeping | 1 | 0.77 |
| 4 | Custom Hiring | 12 | 9.23 |
| 5 | Dairy | 15 | 11.54 |
| 6 | Farm Machinery unit | 1 | 0.77 |
| 7 | Fertilizers & pesticides shop | 16 | 12.31 |
| 8 | Fish Farm | 1 | 0.77 |
| 9 | Goat rearing | 3 | 2.31 |
| 10 | Nursery | 3 | 2.31 |
| 11 | Milk Collection centre | 1 | 0.77 |
| 12 | Milk collection and Consultancy | 1 | 0.77 |
| 13 | Mushroom Farming | 2 | 1.54 |
| 14 | Organic Farm & Jaggery | 2 | 1.54 |
| 15 | Piggery | 2 | 1.54 |
| 16 | Poultry Farm | 4 | 3.08 |
| 17 | Poultry Feed | 1 | 0.77 |
| 18 | Vermicomposting | 1 | 0.77 |
| | Total | 130 | 100.00 |

Source: Primary data

From table 2, it is evident that the 130 respondents had established ventures across a total of 18 different categories such as agri-clinics, poultry farms, dairy farms, mushroom farms, etc. Agri-clinics extend consultancy services to farmers giving them expert advice

on various technologies. Some of the areas covered were soil health, plant protection, cropping practices, crop insurance, animal clinical services, and fodder management. Agri-business centres were Agri-input and supply centres. Close to 50% of the respondents had established agri-clinics or agri-clinics and agri-business centres. Uttar Pradesh stood first in the number of established Agri-clinics and agri-business centres with 2,983 units in Uttar Pradesh out of 8,367 units established nationwide, about 36%.

The large share of respondents in these categories could be attributed to low capital investment, easy access to the market, lower risk, higher demand for products, ease of getting customers, and the agricultural background of respondents.

The second-highest proportion of respondents, about 12%, had established Fertilizers and Pesticides shops in their surrounding areas. Further, 12% of the respondents had established dairy farms and served the farmers through milk collection centres. Compared to the proportion of dairy farms established nationwide, the proportion of respondents who had dairy farms was low. More than 9 % of the respondents ventured into custom hiring centres to serve the farming community by supplying the machinery and equipment required for farming on a rental basis. Other ventures established by respondents were poultry farm (3%), goat rearing (2%), Nursery (2%), Mushroom farming (2%), Organic farm & Jaggery (2%), and Piggery (2%). Beekeeping, Farm Machinery, fish farm, milk collection centre and consultancy, poultry feed, and Vermicompost were started by less than 1% each.

To sum up, Agri-business and agri-clinic centres were the major ventures that were established by the agripreneurs followed by fertilizer and pesticides, dairy farms, and custom hiring centres. The ventures were established between 2010 and 2021. The majority were established in 2019- 28 (nearly 22%) ventures were established, followed by 20 ventures (15%) in 2020. 17 ventures amounting to 13% were established in 2018, 4 ventures (11%) in 2015, 11 ventures (9%) in 2016 and 10 ventures (8%) in 2017. Hence, most of the ventures, i.e. around 77%, were established between 2015– 2020. The year-wise establishment of the ventures is given in Annexure-1 (Table.12).

### 3.3. Motivation behind the establishment of Agri Ventures

Motivation is the driving force that compels an individual to do a specific task. It can also be seen as the reason behind the individual's decision to embark on the journey of setting up an entrepreneurial venture. Entrepreneurial motivation is the process that activates and motivates the entrepreneur to exert a higher level of effort to achieve their entrepreneurial goals. In this section, an analysis of the reasons or motivation behind establishing the ventures of the respondents has been done. Content analysis was applied to segregate the data that was collected from open-ended questions.

**Table 3: Motivation behind agripreneurship**

| S. No. | Reason/Motivation | Number (N-97) | Percentage |
|---|---|---|---|
| 1 | Motivation & training from NTI | 59 | 60.82 |
| 2 | Self-motivation to become a successful entrepreneur | 26 | 26.80 |
| 3 | Motivation from Family | 08 | 8.25 |
| 4 | For better returns through organic farming and to motivate people to use extensively for health benefits | 04 | 4.12 |
| **Total** | | 97 | 100.00 |

Source: Primary data

The table no.3 shows that the agripreneurs were motivated to establish their ventures from the Nodal Training Institutes located in their locality. More than half the respondents opined that NTIs played a vital role in establishing their ventures. NTIs were actively involved in post-training activities such as sending Detailed Project Reports to banks and playing their part in sanctioning loans for candidates. NTIs are providing initial support to the trained aspirants to become agripreneurs which is critical for fresh graduates who may not be well-versed in the financial aspects of loans, subsidies, and other technical factors.

Further, around 26.80% of the respondents opined that they had been passionate about becoming entrepreneurs to serve the farming community, share their knowledge with the farmers and provide high-quality products at low prices. Few of the respondents opined that establishing their own ventures will make them independent and give employment to others. 8.25% of the respondents attributed their success to their parents. Around 4.12% of the respondents stated that their interest in recent trends and developments in organic farming and its market motivated the establishment.

## 3.4. Venture-wise change in income levels of the families

The study described the impact of establishment of ventures in bringing a significant improvement in the income generation of the family by comparing the difference in income levels of families of respondents before the establishment of ventures and the current income. Overall, the data collected revealed that there was a significant improvement in the families' incomes after the establishment of ventures.

Not all ventures in the sample were new. Some ventures were established in the early 2000s as well. However, the majority of them were established between 2015 and 2020. 100 out of the 130 ventures in the sample were established in these five years. There was an exponential growth in the establishment of ventures for the said period. Before establishing the venture, the average family income was ₹ 18,329.90/- which had

increased to ₹ 36,677.02/- after establishment. Overall, the average income of families had doubled post establishment of ventures, indicating that their financial situation had improved drastically. Even though there were other sources of income generation in the families, the change was negligible in nature.

**Table 4: Venture-wise change in income levels of the families before and after the establishment of enterprise**

| S. No. | Venture | Sample in No. (N-130) | Average income (in ₹)/ Per Month | | Difference | % Increase |
|---|---|---|---|---|---|---|
| | | | Before | After | | |
| 1 | Agri-Clinics | 03 | 13277.78 | 20000.00 | 6722.22 | 50.62 |
| 2 | Agri-Clinics and Agri-Business Centers | 61 | 16289.01 | 45600.00 | 29311.00 | 179.94 |
| 3 | Beekeeping | 1 | 8333.33 | 16666.66 | 8333.33 | 100.00 |
| 4 | Custom Hiring | 12 | 16916.67 | 42805.55 | 25888.90 | 153.03 |
| 5 | Dairy | 15 | 15670.56 | 76988.88 | 61318.30 | 391.29 |
| 6 | Farm Machinery Unit | 1 | 50000.00 | 50000.00 | -16666.70 | -33.33 |
| 7 | Fertilizer & Pesticide Shop | 16 | 22875.00 | 43552.08 | 20677.08 | 90.39 |
| 8 | Fish Farming | 1 | 7000.00 | 20833.33 | 13833.33 | 197.61 |
| 9 | Goat Rearing | 3 | 8833.33 | 16611.11 | 7777.77 | 88.05 |
| 10 | Nursery | 3 | 15666.67 | 27277.77 | 11611.11 | 74.11 |
| 11 | Milk Collection Centre & Consultancy | 2 | 12000.00 | 13000.00 | 1000.00 | 8.33 |
| 12 | Mushroom Farming | 2 | 20000 | 27500 | 7500 | 37.5 |
| 13 | Organic Farming and Jaggery | 2 | 11666.7 | 29166.66 | 17500 | 150 |
| 14 | Piggery | 2 | 40000.00 | 133333.33* | 93333.33 | 233.33 |
| 15 | Poultry Farm | 4 | 14750 | 20166.66 | 5416.66 | 36.72 |
| 16 | Poultry Feed | 1 | NA | NA | NA | NA |
| 17 | Vermicompost | 1 | 20000 | 20000 | 0 | 0 |
| **Average** | | | **18329.90** | **36677.02** | 18347.30 | 100.10 |
| **Average overall % increase in income after the establishment of ventures** | | | **100.10%** | | | |

Source: Primary Data*

Analysis of the venture-wise incomes of families before and after the establishment of ventures indicates that those who had dairy ventures witnessed the most considerable income growth. Before establishing dairy ventures, the average income of families was ₹ 15,670.56 which increased to ₹ 76,988.88/- a fourfold increase. Although the dairy ventures constitute only 11.54% of the ventures established, the overall dairies established in Uttar Pradesh as of 29.07.2021 were 2, 642 second highest in the country, after Maharashtra. Uttar Pradesh contributes to one-fourth (25.4%) of the total dairy ventures in India. Further, dairy was the second biggest venture with a share of 33.40% among the 32 different ventures in which agripreneurs established enterprises, in the sample.

The average increase in household income among those who established piggeries was observed to have increased by 233%. This was the second-highest increase recorded among the different types of ventures. In fact, in the case of one of the respondents who established a piggery, family income was ₹2.5 Lakhs, and the average income of those owning piggeries was ₹1.33 Lakh.

The increase in family income was an average of 197.61% in fish farming ventures. Agri-clinics and agri-business centres, which had the highest share in Uttar Pradesh, had recorded a significant average increase of 179.94% from ₹ 16,289 to ₹ 45,600.

Furthermore, it was also seen that the average income increase had more than doubled in custom hiring centres, organic farming, and beekeeping. The increase was 153% for custom hiring centres, 150% for organic farming, and 100% for beekeeping. Fertilizers and pesticides-based ventures had recorded an income increase of 90.4%, goat rearing by 88%, nurseries 74%, agri-clinics by 50.62%, mushroom farming by 37.52%, Poultry by 36.72%, and milk collection centre & consultancy by 8.33%.

In the telephonic discussions, the respondents stated a decent increase in income levels after establishing their ventures. The data also justifies the same for most ventures, except for the farm machinery unit and vermicompost unit, which did not witness a change in income. Both these units were established in 2019, so their turnover must had been affected by the pandemic. Moreover, the agripreneur behind the vermicompost unit had taken a loan of ₹ 5 lakhs for establishing the venture, because of which the family income would not had increased.

To sum up, the establishment of ventures under the scheme had increased the income levels of most families. The overall average increase was recorded as 100.10%, which indicates that agriventures established under the scheme were performing well, which helps encourage more people to take up agripreneurship.

## 3.5. Venture-wise financial outlay and turnover

**Table 5: Venture-wise financial outlay and turnover (Average)**

| S. No. | Name of the Venture | Average | | | % Increase (from First to latest) |
|---|---|---|---|---|---|
| | | Capital Investment (In Rs.) | First Year Turnover (in Rs.) | Latest Annual Turnover (in Rs.) | |
| 1 | Agri-Clinics | 276666.67 | 125000.00 | 250000.00 | 100.00 |
| 2 | Agri-Clinics and Agri-Business Centers | 551750.00 | 1829084.75 | 4228028.02 | 131.16 |
| 3 | Beekeeping | 1500000.00 | 1300000.00 | 2800000.00 | 115.38 |
| 4 | Custom Hiring | 686666.67 | 1136363.64 | 1490909.09 | 31.20 |
| 5 | Dairy | 968400.00 | 1057142.86 | 1885714.29 | 78.38 |
| 6 | Farm Machinery Unit | 800000.00 | 360000.00 | 400000.00 | 11.11 |
| 7 | Fertilizer & Pesticide Shop | 1171875.00 | 1333571.43 | 2155714.29 | 61.65 |
| 8 | Fish Farming | 400000.00 | 100000.00 | 300000.00 | 200.00 |
| 9 | Goat Rearing | 130000.00 | 123333.33 | 206666.67 | 67.57 |
| 10 | Nursery | 693333.33 | 800000.00 | 3650000.00 | 356.25 |
| 11 | Milk Collection Centre & Consultancy | 105000.00 | 575000.00 | 990000.00 | 72.17 |
| 12 | Mushroom Farming | 100000.00 | 3000000.00 | 5500000.00 | 83.33 |
| 13 | Organic Farming and Jaggery | 500000.00 | 150000.00 | 425000.00 | 183.33 |
| 14 | Piggery | 1000000.00 | 2500000.00 | 3000000.00 | 20.00 |
| 15 | Poultry Farm | 750000.00 | 375000.00 | 550000.00 | 46.67 |
| 16 | Poultry Feed | 750000.00 | 550000.00 | 900000.00 | 63.64 |
| 17 | Vermicompost | 150000.00 | 180000.00 | 250000.00 | 38.89 |

Source: Primary Data

Capital investment or the amount invested initially by the venture to enhance its objectives, such as purchasing fixed assets like land, building, machinery, etc could be in the form of cash, assets, or loans. In the study, the capital investment and the turnovers of the agripreneurs had been assessed to evaluate the ventures' performance. From the above table, the majority of the ventures were performing well. By performing well, we imply that the latest annual turnover was more than their capital investment. There had been an

increase in turnover as well, over the years. The increase in turnover from the first year to the latest year ranges from 200.00% in fish farming to just 11.11% in farm machinery-related units.

It is a fact that any business unit will take a significant amount of time to get back their investment and make profits. This time also depends on the venture's nature, including marketing, product mix, etc. This had been reflected in this study as well. It was observed that in agri-clinics, there had been a 100% increase in the turnover in the latest year compared to the first year. However, the capital investment had not yet been recovered from the business operations till now.

Naturally, any business unit that was established may take a significant number of years to get the investment back. The time for the return of the investments may depend on the sector in which the venture is established, product mix, aggressive marketing, etc. The same had been reflected in the above table. In agri-clinics, we can notice a 100% increase from the establishment of the year to the latest period. Yet, the capital investment had not been recovered from the business operations till now. The agri-clinics considered in the study were established in 2018, 2020, and 2021.

Another reason could be the competition from other dealers. Out of 7909 ventures established at the state level, 1118 were agri-clinics, contributing to 14.13% of the total ventures established. At the national level, out of 5345 agri-clinics, UP's contribution was about 21%. Hence, there may be massive competition among the agri-clinics established in the state.

Around 131.16% increase had been recorded in the case of agri-clinics and agri-business centers from the initial year to the latest year. At the same time, there was nearly an 8-fold increase in the latest turnover as compared to the capital investment. Even in the case of agri-clinics and agri-business centres, the share of the number of ventures was significant in state and as well as in centre as shown in Annexure –I.

In the case of Beekeeping, the latest turnover was double that in the first year. An increase of 115.38% was observed. The capital investment was covered in the newest year turnover as depicted in the table.

In the case of Custom Hiring Centers, an increase of 31.2% was observed in the final turnover. The Capital Investment was recovered in the first year itself. Although there was a significant demand for Custom Hiring Centers, a moderate growth (31.2%) had been recorded in the turnover.

About Dairy ventures, a 78.38% increase was observed from first to latest turnovers. The Capital Investment (₹9,68,400.00) was recovered in the first year (₹10,57,142.86) itself. Like in the case of Custom Hiring Centers, there was significant demand for Dairy, which could be the reason behind its growth. At the state level, out of 7909 ventures established,

2642 were Dairy-based, contributing to 33.40% of the total ventures established. There were over 10,851 Dairies at the national level, and Uttar Pradesh accounts for almost one-fourth of the (24.34%) dairies established in the country.

Further, in the case of Nurseries, the increase in turnover was about 356.25%, followed by Fish Farming with 200% increase, Organic Farming and Jaggery based ventures with 183.33% growth, Mushroom Farming with a rise of 83.33%, Milk Collection Centre & Consultancy with 72.17%, Goat Rearing with 67.57%, Poultry Feed with 63.64% growth, Fertilizer & Pesticides Shops with 61.65%, Poultry Farming with 46.67%, Vermicompost with 38.89%, Piggery with 20.00% and Farm Machinery Unit with 11.11% growth. No venture had recorded negative growth.

## 3.6. Venture-wise source of investment

**Table 6: Venture-wise status of loans and subsidy**

| S. No. | Name of the Venture | Source of Investment | | Average Loan Amount | Subsidy Status | | | Average Subsidy Amount |
|---|---|---|---|---|---|---|---|---|
| | | Loan | Self | | Yes | No | Pending | |
| 1 | Agri-Clinics | 2 | 1 | 500000 | 1 | 2 | - | NR |
| 2 | Agri-Clinics and Agri-Business Centers | 36 | 25 | 756800 | 26 | 35 | 1 | 326368.42 |
| 3 | Beekeeping | 1 | 0 | 1000000 | 1 | 0 | 0 | NR |
| 4 | Custom Hiring | 12 | 0 | 581818.20 | 6 | 6 | 0 | 234000 |
| 5 | Dairy | 9 | 6 | 1000000 | 7 | 8 | 0 | 354620 |
| 6 | Farm Machinery Unit | 0 | 1 | NA | NA | | | NA |
| 7 | Fertilizer & Pesticide Shop | 9 | 7 | 506250 | 7 | 9 | 0 | 180000 |
| 8 | Fish Farming | 0 | 1 | NA | 0 | 1 | 0 | NA |
| 9 | Goat Rearing | 0 | 3 | NA | NA | | | NA |
| 10 | Nursery | 0 | 3 | NA | NA | NA | | NA |
| 11 | Milk Collection Centre & Consultancy | 0 | 2 | NA | NA | NA | | NA |
| 12 | Mushroom Farming | 1 | 1 | 1000000 | 1 | 1 | 0 | NR |

| S. No. | Name of the Venture | Source of Investment | | Average Loan Amount | Subsidy Status | | | Average Subsidy Amount |
|---|---|---|---|---|---|---|---|---|
| | | Loan | Self | | Yes | No | Pending | |
| 13 | Organic Farming and Jaggery | 1 | 1 | 500000 | 1 | 1 | 0 | 180000 |
| 14 | Piggery | 2 | 0 | 925000 | 2 | 0 | 0 | NR |
| 15 | Poultry Farm | 2 | 2 | 1242500 | 2 | 2 | 0 | 459500 |
| 16 | Poultry Feed | 0 | 1 | NA | NA | NA | NA | NA |
| 17 | Vermicompost | 1 | 0 | 500000 | 0 | 1 | NA | NA |

Source: Primary Data, NR: No Response, NA: Not Applicable

Out of 130 agriventures, agripreneurs of 54 ventures had made the investments themselves. This was close to 41.5% of the total respondents in the study. Delay in sanctioning the loan may be the reason behind agripreneurs starting ventures with their own money even though the loan was available up to ₹5 lakhs without any collateral, which had been increased to ₹ 10 lakhs recently. The maximum loan could go up to ₹ 20 Lakhs per person. The capital investment for fish farming, goatry, nursery, and milk collection established by the respondents was from their own pocket.

A total of 76 ventures, accounting for over 58.5%, were established using money from loans. Of the 61 agri-clinic and agribusiness centers, 59% were established using loans, and the average loan amount was ₹ 7,56,800. Agriclinics had the minimum average loan of ₹ 5 Lakhs in the study. The initial investment for establishing agriclinics was lower than the rest because of the low infrastructural cost. The highest average loan was ₹ 12,42,500 which was taken by those who had established Poultry. This could be because there were only two poultry-based ventures. The second-highest average loan was ₹ 10 Lakhs, which Dairy, Beekeeping had taken, and Mushroom cultivation. It should be remembered that there was only one venture each under Bee-keeping and Mushroom cultivation that had availed loans. Also, the investment will be high for these ventures because of more significant infrastructure costs compared to other ventures.

Subsidy under ACABC was back-end credit. The subsidy amount was limited to the loan amount out of Total Financial Outflow. The release of subsidies was an indicator of the success and longevity of the venture. Agripreneurs were eligible to avail loans two times with subsidy. Of the 76 persons who had availed loans, the subsidy was released for 54 (46%) and pending for one respondent. The maximum average subsidy amount was ₹ 4,59,500, which was released to poultry farms. This was because the average loan availed by them was the highest. Most agripreneurs who received subsidies had established agriclinics and agri-business centres, and the average amount released was ₹ 3,26,368.42.

The minimum average amount released was ₹1,80,000 to seven agripreneurs who had established fertilizers and pesticides units and one who had established an organic farm.

### 3.7. Venture-wise employment generation and coverage of villages & farmers

The role of agripreneurs in developing agriculture in India, especially in the prevailing economic crisis, was very significant. It benefits growth, the creation of wealth, and quality of life. In a developing economy like India, there was a need to plan and implement policies to support the persons in the agriculture sector. A large section of society depends on agriculture, which could also provide vast employment opportunities in rural areas. (Uplaonkar & Biradar, 2015). The agripeneurship will contribute to the agriculture sector by providing employment opportunities in rural areas, reducing migration, increasing income, and will help in bringing development to rural areas.

**Table 7: Venture-wise employment generation and coverage of villages & farmers**

| S. No. | Name of the Venture | Employment (In No.) | | Total (a+b) | Villages Covered (In No.) | Farmers Covered (In. No) |
|---|---|---|---|---|---|---|
| | | Outsiders (a) | family members (b) | | | |
| 1 | Agri-Clinics | 4 | 10 | 14 | 39 | 800 |
| 2 | Agri-Clinics and Agri-Business Centers | 109 | 75 | 184 | 783 | 84990 |
| 3 | Beekeeping | 3 | 4 | 7 | 12 | 1400 |
| 4 | Custom Hiring | 12 | 14 | 26 | 70 | 6230 |
| 5 | Dairy | 37 | 24 | 61 | 119 | 6095 |
| 6 | Farm Machinery Unit | 1 | 1 | 02 | 5 | 80 |
| 7 | Fertilizer & Pesticide Shop | 24 | 18 | 42 | 1973 | 37757 |
| 8 | Fish Farming | 0 | 1 | 01 | 15 | NA |
| 9 | Goat Rearing | 5 | 5 | 10 | 21 | 125 |
| 10 | Nursery | 14 | 05 | 17 | 169 | 3150 |
| 11 | Milk Collection Centre & Consultancy | 2 | 3 | 05 | 15 | 80 |
| 12 | Mushroom Farming | 8 | 2 | 10 | 20 | 450 |
| 13 | Organic Farming and Jaggery | 5 | 2 | 07 | 12 | 55 |
| 14 | Piggery | 7 | 5 | 12 | 17 | 2050 |

| S. No. | Name of the Venture | Employment (In No.) | | Total (a+b) | Villages Covered (In No.) | Farmers Covered (In. No) |
|---|---|---|---|---|---|---|
| | | Outsiders (a) | family members (b) | | | |
| 15 | Poultry Farm | 7 | 6 | 13 | 47 | 2670 |
| 16 | Poultry Feed | 2 | 1 | 03 | 23 | 2800 |
| 17 | Vermicompost | 1 | 2 | 03 | 05 | 140 |

Source: Primary Data

The employment generated under the scheme was an average of 6 persons per established venture. A total of 1,89,336 employment had been generated in Agriculture and allied sectors under the scheme (P. Kanakadurga and P. Chandrashekara, 2021). In this study, a total of 235 labourers had been employed by the 130 agripreneurs. On average, each venture had given employment to 2 persons. The above table shows that Agri-clinic and agribusiness centres had employed the most labourers with a total number of 166 labourers. Dairy farms hold the second position with a total of 57 labourers. The Firm Machinery unit had generated minimal employment with just two.

Further, the Poultry and Vermicompost units had generated employment for three persons each. As discussed earlier, the number of units was also less in these ventures. It was also found that all the ventures employed family members. In Agri clinic and agribusiness ventures, of the 166 labourers employed, 75 of them were family members. This was a positive impact of the scheme. By establishing at least one venture in each village, there could be a considerable improvement in the employment rate in the agriculture sector.

The ventures that were a part of the study had covered 3,345 villages and 1,48,872 farmers. Farmers were more dependent on agriclinic and agribusiness centres as compared to other ventures. Moreover, the extension services extended by agriclinic and agribusiness centres directly reaches farmers. The 61 agriclinic and agribusiness centres in this study cover 84,990 farmers across 783 villages. Fertilizers and pesticides shops cover a maximum number of villages- 1,973 villages but only 37,757 farmers. This could be attributed to the advisory services and field visits offered by agripreneurs of agriclinic and agribusiness centres and the sale of farm inputs, including fertilizers and pesticides. Extension services help empower farmers by imparting knowledge, skills, and training about farm management practices, giving them advice on scientific problems they face, and providing support to them for arriving at solutions to their problems. Generally, it was observed that agriventures that provide extension services cater to more farmers because of the plethora of services offered. In this study, fish farming units had been reported to had covered zero farmers due to the lack of extension services.

### 3.8. Challenges faced by agripreneurs

At the time of the establishment of a venture which was either a new business that was allied to the agri-sector or any other support business, agripreneurs were faced with multiple challenges. The multiple difficulties ultimately point to the root problem - the lack of entrepreneurial abilities among farmers and Agri-graduates. Challenges including fear of risk, competition among other entrepreneurs, lengthy banking procedures, etc also arise from the lack of entrepreneurial skills or experience among the farmers/Agriculture graduates. In this section, the challenges faced by agriprenuers in the early stages of entering agriprenuership had been discussed.

**Table 8: Challenges faced by Agripreneurs at the initial stage**

| S.No. | Major Initial Challenges | Frequency | Percentage |
|---|---|---|---|
| 1 | Sanction of bank loans | 40 | 30.77 |
| 2 | Fear about the risk involved in the business | 08 | 6.15 |
| 3 | Competition from the other dealers | 09 | 6.92 |
| 4 | Inadequate knowledge on the venture to be established | 02 | 1.54 |
| 5 | Linkages with Farmers/ to bring the faith among farmers | 05 | 3.85 |
| 6 | Banking procedures | 10 | 7.69 |
| 7 | Rising fuel costs | 03 | 2.31 |
| 8 | Whether they will get the fair prices to the produced product | 03 | 2.31 |
| 9 | Lack of knowledge about how to market their product | 16 | 12.31 |
| 10 | Providing good quality products for lower prices | 03 | 2.31 |
| 11 | Finding customer base | 02 | 1.54 |
| 12 | No challenges | 29 | 22.31 |
| | Total | 130 | 100.00 |

Every entrepreneur- novice or experienced, when starting a venture must overcome multiple challenges for successful establishment. Nearly 31% of the respondents- about 40- stated that getting the sanction for bank loans was the biggest challenge. Almost 58% of the respondents in the study financed their establishment through loans. Even though the scheme offers loans up to ₹ 10 lakhs without collateral support (earlier, it was five lakhs), bankers deny the loans because they lack awareness about the scheme. Lack of awareness among bankers was observed to be more common in rural areas. Another reason for the banks to deny loans could be insufficient documentation or the mistakes in the documents. Bankers may also assume that sanctioning loans to agri-sectors was risky. An additional 8% of the respondents, stated that banking processes were the hurdles they faced.

As mentioned earlier, the proper documentation process was compulsory, and lack of requisite handholding support leads to these challenges. Sixteen respondents accounting for more than 12%, felt that their lack of knowledge on how to market their product was the hurdle, and two respondents stated the lack of knowledge on the established venture as the challenge. Many farmers or Agri graduates start their ventures without any knowledge about the market or any entrepreneur skills. In numerous cases, including some of the respondents, it was observed that they started their venture at first and later joined the AC&ABC training program. Moreover, many individuals directly join the AC&ABC training after completing intermediate in agriculture. Such individuals need not had the requisite experience or skills in agripreneurship.

Even though many agripreneurs did not get any financial support, the training helped them scale up their business and gain agripreneurship skills. Nearly 7% of the respondents cited competition from other dealers as their challenge, while more than 6% feared the risk involved in the establishment of the business. Both these challenges could be linked to the lack of entrepreneurial abilities. Three respondents stated rising fuel prices as the reason which was very common to most sectors now. Another three respondents mentioned the provision of good quality products for lower cost and uncertainty in getting a fair price for their goods as the prime challenge faced. 2 respondents were apprehensive of finding a customer base. Surprisingly, 22% of the respondents stated that they did not face any challenge.

### 3.9. Constraints faced by the Agripreneurs

Earlier, the challenges faced in the initial stages of starting a venture were discussed. Here, challenges while operating the venture is discussed. Even if agripreneurs overcome the challenges in the initial stages, they were faced with more challenges while operating their venture. Such problems, which were interrelated, may affect the profitability of the venture.

**Table 9: Constraints faced by the Agripreneurs in operating the venture**

| S. No. | Constraints | SA | A | N | D | SD | RBQ value | Rank |
|---|---|---|---|---|---|---|---|---|
| 1 | Insufficient Funds | 3 | 89 | 15 | 10 | 13 | 69.08 | IV |
| 2 | Delay in Getting loans from the banks and refusing to sanction the loan | 64 | 33 | 15 | 04 | 14 | 79.85 | I |
| 3 | No awareness among the farmers | 09 | 23 | 75 | 11 | 12 | 60.92 | VI |
| 4 | Marketing | 63 | 26 | 13 | 18 | 10 | 77.54 | II |
| 5 | Competition from MNCs | 59 | 28 | 16 | 08 | 19 | 75.38 | III |
| 6 | Lack of technical know how | 03 | 85 | 10 | 16 | 16 | 66.62 | V |

Here, Rank Based Quotient or RBQ value had been calculated for each of the six responses recorded. Delay in getting loans from banks and refusal to sanction the loan by the bank was ranked 1 with an RBQ value of 79.85. This constraint was faced by those agripreneurs who start their businesses using their own money before getting loans. As discussed earlier, some agripreneurs join the training program after establishing their venture. The bank's delay in bank loans and refusal to sanction loans was the operational challenge for such respondents.

Not far behind, marketing was ranked 2 with RBQ 77.54, followed by competitions from MNCs ranked 3 with RBQ 75.38. This may be because of the poor entrepreneurial skills among the agripreneurs. Lack of technical know-how or technical knowledge had an RBQ value of 66.62 and was ranked 5. Once an agripreneur establishes a venture, it will be challenging to participate in other training programs that teach modern techniques. This will affect their ability to compete with MNCs and upcoming Agri ventures. 'Insufficient funds' was ranked 4 with an RBQ of 69.08. Agripreneurs will incur more expenses and the day-to-day operating cost to compete with other ventures and promote their experiences among farmers. It will be a financial burden for the small-scale agripreneurs if they set aside some amount from their daily income for this purpose. Lack of awareness among farmers about the venture with an RBQ of 60.92 was ranked 6. The poor awareness may be due to the poor marketing and promotion of the venture. This constraint was predominant among newly established ventures.

### 3.10. Business strategy adopted by Agripreneurs for their venture's success

Business strategy is essential for an entrepreneurial venture to achieve its goals. Various approaches used are providing information, extending support and guidance, overcoming barriers, and providing resources. A good business strategy considers people, money, persistent hurdles, and resources availability in line with the venture's goals, vision, and mission (Abdulwase R, 2020).

**Table 10: Business strategies adopted by Agripreneurs**

| S.No. | Business strategies | Frequency (N-130) | Percentage |
|---|---|---|---|
| 1 | Personal attention in attending farmers problem | 51 | 39.23 |
| 2 | Strong distribution network | 28 | 21.54 |
| 3 | Quality and low price | 48 | 36.92 |
| 4 | Promotion of product and publicity | 31 | 23.85 |
| 5 | Good contact with the dealers | 27 | 20.77 |
| 6 | Good communication with farmers | 50 | 38.46 |
| 7 | Offering quality advice to farmers | 33 | 25.38 |
| 8 | Others | 0 | 0.00 |
| | **Total** | **130** | **100.00** |

The respondents were asked what, according to them, was their unique approach or unique element which helped their venture succeed and compete with other agripreneurs in the same field. They could use more than one element. For instance, a venture could provide good quality products and maintain good communication with their farmers at a low rate. Fifty-one respondents amounting to more than 39% of the total 130, responded that their personal attention to the farmers' problems was what they considered their critical success factor. 38% of the respondents, stated that they maintained good communication with the farmers. Providing good quality products at a lower price was the critical success factor cited by 48 respondents (37%). More than one-fourth of the respondents offered quality advice to farmers. This helps them overcome initial challenges such as promoting venture among farmers, trust among farmers, and competition from other dealers. Promotion of product and publicity was the factor cited by 31 respondents (nearly 24%). Twenty-eight respondents replied that they had a strong distribution network. Twenty-seven respondents (21%), stated that they had good contact with the dealers. These strategies may had helped the ventures overcome the hurdles of marketing, finding customer base, and competition from MNCs.

## 4. Discussion

Based on the data collected and interaction with agripreneurs in the study, it was observed that the AC&ABC training programme had benefitted them financially and in the development of their entrepreneurship skills. The majority of the agripreneurs were people aged 18 to 44 years which was a clear indication that the programme had provided a platform for youngsters to become entrepreneurs and scale up their businesses. Furthermore, most participants hail from families involved in the agriculture sector, which point towards the shift from exclusively agriculture to agripreneurship alongside agriculture in the current generation.

However, female representation under the scheme in Uttar Pradesh state lags as compared to the model in some other states like Tamil Nadu and Maharashtra. The number of women who had undergone training was low, and those who had established ventures were minuscule. No female participants took part in the study because of the poor representation. Likewise, the representation from Scheduled Castes and Scheduled Tribes was also poor in the state, resulting in poor representation in the study. Thus, it was evident that the scheme's reach was generally low among females, SCs, and STs, and financially backward (BPL) persons in Uttar Pradesh.

The easy entry into the market and lower capital investment were the reasons behind establishing a relatively more number of Agri-Clinics & Agri-Business Centres in the state. Similarly, suppose other businesses such as mushroom cultivation, bee-keeping,

and fish farming were provided with easy entry into the market. In that case, agripreneurs will be encouraged to venture into these businesses as well. For instance, government lands may be allotted to Agripreneurs on a lease basis to establish dairy, Poultry, and piggery ventures for which more space was required will help in reducing the capital investment for agripreneurs.

Overall, by establishing agriventures, family incomes of households had doubled. Moreover, the turnover of those agripreneurs who participated in the study had increased over the years. It was also seen that the duration of the establishment of a venture influences the change in turnover. Those establishments established post 2018 had a lower turnover than those established earlier, say in 2010. Thus, extending support to the agriventures for up to three years post establishment will help the agripreneurs.

Although the scheme offered loans and subsidies, most agripreneurs had invested out of their own pockets. The difficulty in availing of the loans and delay in sanction were the reasons cited by the respondents. Sensitizing the bankers about the scheme, especially in rural areas, was necessary even after two decades since the implementation. For this, NTIs should ensure participation of bankers from the locality of training candidates in functions such as screening for candidates, inauguration, and valedictory ceremony. NTIs should confirm the accuracy of Detailed Project Reports with assistance from bankers and NABARD officials. This may help address the problems faced by agripreneurs concerning loans. Also, only about one-half of the agripreneurs who availed loans had received a subsidy in this study may be because of document-related issues. Banks and NABARD must develop a system that updates the status of DPRs to the NTIs for regular follow-up and timely clearance of issues.

By setting up ventures under the scheme, employment had been generated, which was a positive sign. Thus, by establishing agriventures at the village level, employment in the agriculture sector will boost. Agriventures under the scheme were covering farmers by providing extension services which was an added advantage of the scheme.

Agripreneurs were faced with numerous challenges throughout the initial stages of establishment as well as during operation. Apart from the financial difficulties, most challenges arise from the lack of entrepreneurial skills. Entrepreneurial skills were a part of the training received under the scheme. Yet, upon establishing their ventures, conducting workshops and training sessions like Refresher Training Programs (RTPs) to update their knowledge and skills will prove to be helpful for the agriventures. Marketing skills should be highlighted in training programs. Information on other schemes and programmes that will support the agripreneurs must be shared with them regularly. Hosting interactive sessions for candidates with successful agripreneurs will be a motivation for the candidates.

## 5. Conclusion

In this study, the socio-economic status of agripreneurs, diversity of agriventures, impact, and benefit for the agripreneurs had been explored. The challenges faced, and measures were taken to overcome them had also been examined.

Even though the study was carried out in only one state, the status and majority of the issues/constraints could be generalized to the agriventures under AC&ABC in other states. AC&ABC

had enabled the transformation of the Indian farming community from a traditional way of cultivation to entrepreneurship-based farming. The performance of the scheme and the agriventures under it had been evaluated in this study. There is a wide range of benefits presented by the scheme whose objective targets agriculture graduates. Agripreneurs were benefit financially as their overall family income had doubled post establishment of the venture. Farmers benefitted from the extension services provided by the agriventures. Agriventures had also helped in generating employment in agriculture and allied sectors. We also observed that NTIs had a strong influence in motivating participants of training programmes to establish ventures.

However, the scheme was yet to penetrate the vulnerable sections of society. Likewise, there were other constraints concerning the scheme's success that needs to be addressed. Incorporating into the scheme's implementation, the suggestions based on the study's findings will help enhance the outcomes and success of the AC&ABC scheme.

## ANNEXURE-1

**Table 11: District-wise Sample distribution of the respondents of Uttar Pradesh**

| S.No. | District | Sample | Percentage |
|---|---|---|---|
| 1 | Alighar | 3 | 2.31 |
| 2 | Ambedkar Nagar | 2 | 1.54 |
| 3 | Amethi | 2 | 1.54 |
| 4 | Amroha | 19 | 14.62 |
| 5 | Auraiya | 1 | 0.77 |
| 6 | Ayodhya | 1 | 0.77 |
| 7 | Badaun | 2 | 1.54 |
| 8 | Baghpat | 2 | 1.54 |
| 9 | Barabanki | 9 | 6.92 |

| S.No. | District | Sample | Percentage |
|---|---|---|---|
| 10 | Bareilly | 3 | 2.31 |
| 11 | Bhadohi | 2 | 1.54 |
| 12 | Bijnor | 2 | 1.54 |
| 13 | Bulandsahar | 10 | 7.69 |
| 14 | Chitrakoot | 1 | 0.77 |
| 15 | Etawah | 1 | 0.77 |
| 16 | Fatehpur | 1 | 0.77 |
| 17 | Gonda | 1 | 0.77 |
| 18 | Hamirpur | 1 | 0.77 |
| 19 | Hapur | 1 | 0.77 |
| 20 | Hardoi | 4 | 3.08 |
| 21 | Haridwar | 1 | 0.77 |
| 22 | Jalaun | 1 | 0.77 |
| 23 | Jhansi | 1 | 0.77 |
| 24 | Kaushambi | 2 | 1.54 |
| 25 | Lakhimpur Kheri | 3 | 2.31 |
| 26 | Lalitpur | 4 | 3.08 |
| 27 | Lucknow | 1 | 0.77 |
| 28 | Meerut | 10 | 7.69 |
| 29 | Mirzapur | 1 | 0.77 |
| 30 | Moradabad | 5 | 3.85 |
| 31 | Muzaffar Nagar | 12 | 9.23 |
| 32 | Pili bhit | 3 | 2.31 |
| 33 | Prayagraj | 1 | 0.77 |
| 34 | Rae Bareli | 2 | 1.54 |
| 35 | Rampur | 5 | 3.85 |
| 36 | Saharahpur | 3 | 2.31 |
| 37 | Shamli | 6 | 4.62 |
| 38 | Shrawasti | 1 | 0.77 |

Source: Primary data

**Table 12: Year-wise distribution of establishment of the ventures under survey**

| S.No. | Year | No. of Ventures |
|---|---|---|
| 1 | 2003 | 1 |
| 2 | 2010 | 2 |
| 3 | 2011 | 5 |
| 4 | 2012 | 5 |
| 5 | 2013 | 4 |
| 6 | 2014 | 9 |
| 7 | 2015 | 14 |
| 8 | 2016 | 11 |
| 9 | 2017 | 10 |
| 10 | 2018 | 17 |
| 11 | 2019 | 28 |
| 12 | 2020 | 20 |
| 13 | 2021 | 4 |
| | Grand Total | 130 |

Source: Primary data

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# Using ICT and Social Media as Feedback Mechanism for Central Schemes by Beneficiaries

**Kanchan Bhagwat[1], Manisha Ohlan[2] and Mahantesh Shirur[3]**

## ABSTRACT

*Diploma in Agricultural Extension Services for Input dealers (DAESI) is an important scheme which enables the input dealers to serve farmers with timely and sound advisories. After one year of rigorous training program, 90 participants from nineteen states recorded their videos and got benefited and were in a position to identify the problems in their region with respect to management of pest and diseases, doses of fertiliser's application, with improvement in business and communication skills, and increase in self-confidence level with upgradation of knowledge. The data was assessed on a set of 12 questions in which the participants recorded their responses through videos and revealed that they were very satisfied with the one year DAESI training programme.*

**Keywords:** Input Dealers, DAESI, Training, Farmers and Extension, ICT, Social Media

## Introduction

In India, there are about 2.82 lakh practicing agri-input dealers, who are the prime source of farm information to the farming community. Two important factors for the development of agriculture are research and extension (DAESI Samachar). In India, among the extension group, Agri input dealers have become one of the important sources of agri-farm information to the farming community though not equipped with adequate knowledge (Singh. N., 2021). While purchasing different inputs required for farming operations, the farmer naturally tries to find out from the input dealer about the usage of inputs, both in terms of quality and quantity. However, most of these input dealers do not have formal agricultural education. If these input dealers can be shaped as para-extension professionals by providing requisite knowledge, they can professionalise extension services and contribute to bring a paradigm shift in Indian Agriculture. It is in this context, the National Institute of Agriculture Extension Management (MANAGE) has designed a one-year diploma course titled 'Diploma in Agricultural Extension Services for Input Dealers (DAESI)', for input dealers who are already in business and want to enter into the

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business. MANAGE has launched DAESI program in the year 2003 and recently so far covered the practicing input dealers in 19 states like Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, Orissa, Jharkhand, Uttar Pradesh, Punjab, West Bengal etc.

## Methodology

The data in the form of short documentary videos were invited from all trained input dealers across the country through electronic mails, WhatsApp and online surveys. For that a well-structured Google Forms was prepared with a set of 12 questions and same data was compiled. The proposed set of questions includes name of programme/ projects, name of participants, district location, language used for making videos, knowledge gained, training demonstrations given, type of support availed and impact of scheme/ training etc. The participants as respondents of the study were comprised of farmers, entrepreneurs, input suppliers, marketing agents etc. The participants were allowed to submit videos in their native language. In the video making process, participants were asked to identify specific problems/ solutions in their work area and try to solve the same with the help of skills acquired during the training programme. The responses were received from 90 participants and all recorded responses were analysed by using frequency and percentage methods.

## Results and Discussion

## The Distribution of Participants based on states

The findings of the present study as well as relevant discussions have been summarized under the following heads: The Distribution of Participants based on states, Duration of videos, Language used by the input dealers, Location of the Dealers' Shop, Acknowledgement of input dealers for different official departments and Knowledge gained after enrolling in DAESI Course and feedback received after the training programme by the respondents.

**Table 1: The Distribution of Participants based on states (n=90)**

| S. No. | States | Number of respondents |
|---|---|---|
| 1 | Andhra Pradesh | 5 |
| 2 | Bihar | 10 |
| 3 | Himachal Pradesh | 7 |
| 4 | Jharkhand | 6 |
| 5 | Karnataka- N | 4 |
| 6 | Karnataka -S | 1 |
| 7 | Kerala | 2 |
| 8 | Maharashtra | 14 |
| 9 | Orrisa | 6 |

| S. No. | States | Number of respondents |
|---|---|---|
| 10 | Punjab | 6 |
| 11 | Rajasthan | 6 |
| 12 | Tamil Nadu | 2 |
| 13 | Telangana | 3 |
| 14 | Uttar Pradesh | 9 |
| 15 | Uttarakhand | 2 |
| 16 | West Bengal | 7 |
| | **Total** | **90** |

There were ninety (90) participants from nineteen different states of India. The details of the same are given in table 1. It depicts that, out of total 90 participants, the highest number of documentary videos were collected from Maharashtra (14). 10 from Bihar and 9 from Uttar Pradesh. Whereas, 7 each from West Bengal and Himachal Pradesh and 6 each from Jharkhand, Orissa, Punjab and Rajasthan. And one from South Karnataka and 2 each from the states of Kerala, Tamil Nadu and Uttarakhand.

## Duration of Videos

Table 2 shows the details of duration of recorded videos by participants. It is apparent that 64.44% of the participants recorded their responses in the duration 1- 2 minute, whereas, 18.88% of the participants recorded their responses in 0-1 minute followed by 7.77% of the participants who recorded their responses in the duration of 2-3 minute. Only 3 participants took more than 3 minute to complete their video.

**Table 2: Duration of videos** **(n=90)**

| S.No. | Duration of videos (Minute) | Number of videos | % |
|---|---|---|---|
| 1 | 0-1 | 17 | 18.88 |
| 2 | 1-2 | 58 | 64.44 |
| 3 | 2-3 | 7 | 7.77 |
| 4 | 3-4 | 3 | 3.33 |

### Language used by the Input dealers

Languages used by the input dealers for recording their videos were collected and is displayed in Table 3. It is observed that, out of the 90 received videos, 48 participants used Hindi language followed by 8 participants who used English. Another 7 participants used Marathi and Punjabi language to recording their videos. Only 4 number of the participants used Odiya. There were a total of 3 videos recorded in Kannada and 1 in Malayalam language.

**Table 3. Language used by the Input dealers: (n=90)**

| S.No. | Language | Number of respondents |
|---|---|---|
| 1 | Hindi | 48 |
| 2 | English | 8 |
| 3 | Telugu | 6 |
| 4 | Marathi | 7 |
| 5 | Bengali | 6 |
| 6 | Punjabi | 7 |
| 7 | Odiya | 4 |
| 8 | Kannada | 3 |
| 9 | Malayalam | 1 |

**Location of the Dealers' Shop**

The details of the location of the dealer's shop is presented in table 4. Out of the total, 43 number of the input dealers' shops are located at block level followed by 25 at district level and 22 at village level respectively.

**Table 4. Location of the Dealers' Shop (n=90)**

| S.No. | Location of the Dealers' Shop | Frequency |
|---|---|---|
| 1 | Village | 22 |
| 2 | Block | 43 |
| 3 | District | 25 |

**Number of participants acknowledging institutions:**

Figure 1 depicts the percentage of the input dealers who accorded credit to the seven stakeholders involved in the process i.e. Acknowledgement with Ministry, MANAGE, DAO, facilitators, Resource persons, NTI / KVK/ATMA and others.

The findings clearly shows that, majority of the participants (78%) of the respondents acknowledged the role of facilitators. More than 68.88 % of the respondents acknowledged the role of MANAGE and resource persons as DAESI was conceptualised by MANAGE institute at national level. (Whereas, State Agricultural Management and Extension Training Institute (SAMETI) which is a state level implementing agency for DAESI). 62.22% of the respondents acknowledged the role of various Nodal Training Institutes (NTIs), Krishi Vigyan Kendra (KVK), Agriculture Technology Management Agency (ATMA) and NGOs. Whereas, 28.88% of the input dealers acknowledged the role of the Ministry. Only 20% of the respondents acknowledged the role of DAO.

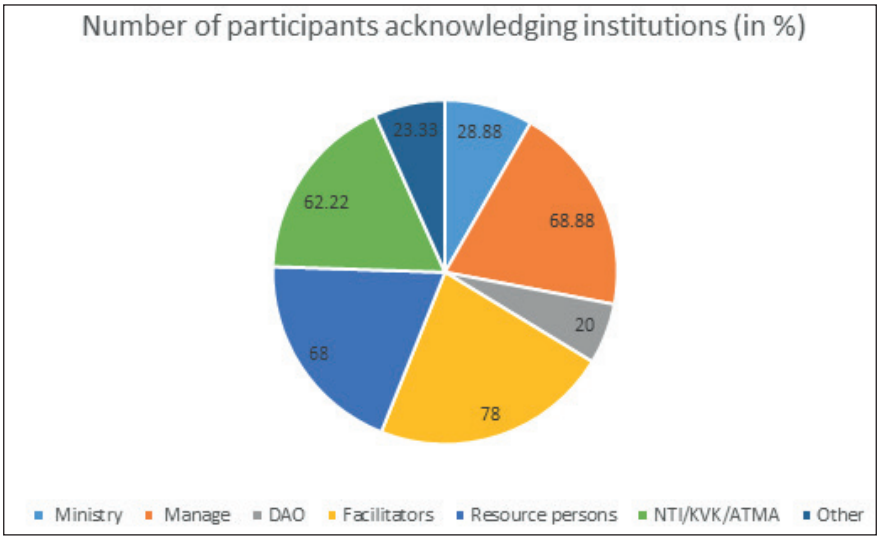


**Fig.1. Number of participants acknowledging institutions.**

Therefore, it was concluded from the above figure that the majority of the respondents have acknowledged and emphasized the role of facilitators in the successful implementation of the DAESI programme, as well as providing the means to become para extension workers to assist the farming community. The probable reason for this might be the fact that facilitators play an important role in the DAESI program as they assist in the preparation of the annual session plan, coordination with agriculture departments and agribusiness companies, and arranging the best resource persons to deliver the sessions to the DAESI diploma holders.

Similarly, participants acknowledged the role of MANAGE and Nodal Training Institutes (NTIs) as they provide the services at national and district level.

**Benefits gained by the input dealers**

It is important to determine that individuals are making use of the knowledge and skills that they have acquired during the training program (Shirur *et al*., 2020,). While perusing implementation of DAESI training, participants got anticipated and identified various new aspects which are enlisted in table 5. The details of expected changes indicated by participants is very appreciable. Some have given more than one similar record. Hence, the data was tabulated based on keywords.

The data depicts that 84.44% of the input dealers got benefited and helped other farmers and peer input dealers followed by 83.33% of the respondents who gained knowledge on fertilizer application after enrolling in the DAESI Course, another 71.11% of the participants observed with the improvement in business skills. Further, 68.88% indicated

that they gained good knowledge of agrochemicals, followed by 63.33% of the respondents who stated that they gained knowledge about seed treatment.

Further the findings showed that, 62.22% of the respondents felt an improvement in communication skills, followed by 60% who can now easily analyse the soil heath card. About 56.66% also agreed that they felt an increase in the level of self-confidence among themselves.

Less than two fifth (38.88%) of the respondents indicated that they had very good learning of farm Machinery & Implements while 27.77% respondents informed that they got benefited on various others aspects of training course.

**Table 5: Benefit gain by the input dealers after enrolling the course**

| S.No. | Statements of Knowledge gained on different aspects | Yes | % |
|---|---|---|---|
| 1 | Soil health analysis | 54 | 60 |
| 2 | Seed treatment | 57 | 63.33 |
| 3 | Agrochemicals | 62 | 68.88 |
| 4 | Farm Machinery & Implements | 35 | 38.88 |
| 5 | Dose of fertilisers | 75 | 83.33 |
| 6 | Other | 30 | 33.33 |
| 7 | Improvement in business skills | 64 | 71.11 |
| 8 | Improvement in communication skills | 56 | 62.22 |
| 9 | Increased in self-confidence | 51 | 56.66 |
| 10 | Helping farmers and peer input dealers | 76 | 84.44 |
| 11 | Other | 25 | 27.77 |

On the basis of other content received from the videos, out of 26 respondents, a total of 3.33% of the participants started organic farming, use of the Bio-fertilizer application gained by accurate knowledge and delivered proper advice and services to the farmers. DAESI training helps to increase practical knowledge and to solve problems related to the field. They also suggested proper use of straight doses of fertilizers and seed treatment to the farmers and also motivated upcoming dealers to enrol for the DAESI course. While another 2.22% indicated use of improved new technologies and machineries in farming business and got more knowledge in physical classes than online mode and 1.11% of the respondents felt that due to field visits at processing industries, soil testing laboratories, metrology, and visit to progressive farmer's field, helped to create awareness among them. Moverover, DAESI physical classes increase the practical knowledge of dealers to solve the actual problems related to the field.

## Conclusion

Training people about addressing field problems is a certain way to bring desirable changes among them. (Shirur *et al*., 2020). The findings of the study revealed that, most of the participants acknowledged the role of facilitators, MANAGE, NTI, Ministry and DAO institutions in providing advisory support and transforming them as para extension professionals. Majority of participants agreed that, they got benefited and were in a position to identify the problems in their region based on the knowledge gained during DAESI training program with respect to identification of Soil health card, Seed treatment, fertiliser application, management of pest and diseases, improvement in communication skills, and increased in self-confidence level. This confidence will have a double benefit in diversifying their enterprises and also to give value added extension services to the farmers. The dealers based on their major problems related to farming, developed and learnt new technologies and practices to resolve it. The training methodologies used were relevant and fulfilled the expectations shown in the videos received from the participants.

## Recommendation

Small percentage of participants thought that, if they get the course material in their native language, it will be easy for them to study and understand each subject clearly. Furthermore, an increase in the number of exposure/ fields visit, results in improving the practical knowledge of dealers to solve their actual problems related with agriculture. Hence, it is comprehensively suggested that there is scope for MANAGE, to further increase and organise practical/ field visits to the maximum extent possible.

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# One Health Approach: Researchable Areas for Stakeholders

**Shamali Phand[1], Veenita Kumari[2] and Shahaji Phand[3]**

## ABSTRACT

*One Health is a collaborative, multisectoral, and transdisciplinary approach working at the local, regional, national, and global levels with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment. One health is approach which recognizes that health of people is closely associated with animal health and our shared environment. In 2004, Wildlife Conservation Society gave the concept of "One world, One health". One health approach is very important factor to safeguard human health and increase the pandemic preparedness like covid19. Increased animal human interface indicates the need of one health approach. Execution of one health approach will help to achieve the UN agenda 2030 that is sustainability development goals. This study is based on desk research and review of secondry data and published literature on the topic. To support the secondary data, the primary data was collected via structured google form questionnaire to the five concerned stakeholders with total sample size 25 and panel discussion with five renowned experts. Study found many researchable areas w.r.t concerned stakeholders. Recommendation in areas of one health is explained in this study. There is need of extension institute like MANAGE to step into one health concept in context of capacity building and providing common platform for all concerned stakeholders.*

**Keywords**: One Health, Zoonosis, Plant Health, Animal Health, Environment.

## Introduction

One Health is a project combining "the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals and our environment", as defined by the One Health Initiative Task Force.

The COVID-19 pandemic has irreversibly changed the world like never before. Though this is not the first pandemic which has originated from aberrations at the human-animal environment interface, it is the phenomenal impact on global health and economy that has forced the global community to perceive and respond to pandemics in a greater scientific

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way. COVID-19 pandemic is neither the first and nor the last to have developed from close contact between humans and wildlife. The Severe Acute Respiratory Syndrome (SARS) pandemic in 2002–2003 and the Middle-East Respiratory Syndrome (MERS) event in 2011 were traced to human interaction with animals. Nipah virus in Kerala 2018 records the death of 17 patients amongst total 19 cases show 89.4% fatality rate. It is well established that 75 per cent of new or emerging infectious diseases originate from animals. Union Health Minister Dr. Harsh Vardhan said that human health cannot be seen in isolation in an era that has increased interaction between humans and animals resulting in a need for 'One Health' approach. "India is one of four global hotspots where there is a huge risk of emergence of infectious zoonotic diseases, drug resistance and foodborne infections," he warned.

One Health is gaining recognition in the United States and globally as an effective way to fight health issues at the human-animal-environment interface, including zoonotic diseases. Successful public health interventions require the cooperation of human, animal, and environmental health partners. Professionals in human health (Doctors, Nurses, Public Health Practitioners, Epidemiologists), animal health (Veterinarians, Paraprofessionals, Agricultural workers), environment (Ecologists, Wildlife experts), and other areas of expertise need to communicate, collaborate on, and coordinate activities. Other relevant players in a One Health approach could include law enforcement, policymakers, agriculture, communities, and even pet owners. No one person, organization, or sector can address issues at the animal-human-environment interface alone.

**Objectives**

1) To review the existing literature on One Health Approach.
2) To identify researchable areas in One Health Approach.
3) To identify line of action for extension/public health organizations in One Health Approach.

## Review of Literature

The studies are reviewed and presented under following major heads

**1) Zoonoses and One Health.**

**Bidaisee et al., (2014)** studied available literature on one health in zoonoses. No publications noted in 1985, 1990, 1991. In 1995 only 8 resources found but in 2009 total 43 resources were available. 2010 and 2012 were most productive years as there was 71% production. A total of 335 emerging infectious diseases were identified between 1940 and 2004. Considering that more than 60% of infectious diseases are zoonotic, they have an important and increasing impact on human health. Considering the significance of agriculture and food safety, it was surprising that these scopes did not have a greater representation in the literature reviewed.

**D. Katterine Bonilla-Aldana et al., (2020)** studied one health concept in context to covid19. COVID-19 has presently spread to more than 82 countries, apart from China from where it originated. As per the most recent situation report of World Health Organization (WHO), a total of 94,355 confirmed cases and 3,222 human deaths have been reported till March 4, 2020. This virus was designated as a Public Health International Emergency on January 30, 2020 and a potential pandemic. Seeing the rapid increase in the number of cases affected and its further spread to many countries in all the populated regions of the world, except Antarctica. Virus was designated as a Public Health International Emergency on January 30, 2020.The possibility of a fourth outbreak can be expected in the coming future.

**2) Overall initiatives for one health approach**

**The Indian Express (2022)** stated that Human health cannot be seen in isolation in an era that has increased interaction between humans and animals resulting in a need for 'One Health' approach. With increased interaction between humans and animals, human health cannot be seen in isolation and covid 19 is reminder to this fact. COVID-19 demonstrates the rapid spread of novel pathogens which can have a significant impact on the global economy. Preparedness for, and mitigation of such events require a 'One Health' approach.

**Times of India, (2021)** The Department of Biotechnology has launched a 'One Health' consortium that envisages carrying out surveillance of important bacterial, viral and parasitic infections of zoonotic as well as transboundary pathogens in the country. This Consortium, consisting of 27 organisations led by DBT-National Institute of Animal Biotechnology, Hyderabad, is one of the biggest one health programs launched by Govt of India in post-COVID times.

**3) Antimicrobial resistance and one health**

**Food and Agriculture Organization of United Nations (FAO) (2021)** The antibiotics are used in animals for therapeutic and prophylactic purposes. In addition, these agents are used for a growth promotion role as a low-cost alternative to poor sanitation in and around animal habitat. Indiscriminate use of antimicrobial agents causes emergence and selection of resistant pathogens having a potential to spread through animal-human interaction or food chain. These resistant pathogens cause diseases in humans that inadequately respond to affordable antimicrobials. AMR is now recognized as one of the biggest challenges in mankind's fight against infectious diseases. One Health approach is the globally accepted solution to mitigate AMR. 3.5% GDP reduction will be there by 2050.One Trillion dollar will be the additional healthcare cost.100 trillion-dollar loss of global economy by 2050.

**4) Stakeholders in One Health**

**Mazet et al., 2014** explored the groups and institutions with an interest in safeguarding the health of people, domestic animals and ecosystems and came with stakeholders like government sectors which comprises of health, animal health, environmental health, forest and wildlife etc. Non-government sectors such as Private sector for animal and human. Non-government organisations etc. and international organisations such as World health organisation, centre of disease control and FAO etc.

**Rajib Dasgupta et.al (2021)** says that there is need to adopt intersectoral one health approach in India by one health committees. Bottom to top approach should be operationalised through frontline community workers, animal health workers, forest officers and farmers etc. So that interventions can be done for the grassroot level. A deeper understanding of local priorities shall help shape the nature of one health collaborations. Strategies and activities need to be based on common and shared values and nested within existing infrastructure. Effective governance will be shaped by legal and policy frameworks that are aligned with current structures and comply with relevant national and international standards. The role of strong sectoral systems cannot be overemphasized as operational aspects shall be shaped by these in the final analysis. Academic institutions will play a crucial role in shaping and facilitating One Health education.

**5) One Health in relation to climate change and pollution.**

**Burney J. et al., (2014)** studied the effect of climate change and air pollution on Indian agriculture. Air pollution in India has become so severe that yields of crops are being cut by almost half. The yield of the crops like wheat, rice is decreased. Researchers analysed yields for wheat and rice alongside pollution data, and concluded significant decreases in yield could be attributed to two air pollutants, black carbon and ground level ozone. These two pollutants affect the crop yield and results into food insecurity and scarcity.

**Zinsstag, J. et al., 2018** studied the effect of climate change on one health adaption. Came up with major findings that integrated human and animal surveillance and response systems (ISRS) are one of the most important contributions of a One Health approach to mitigate effects of climate change. Climate change contributes in increase in pathogens and viruses. Climate change usually makes environment which is favourable for microbes and viruses to grow. This directly impacts the crop yield. Scarcity in crop will result in food security.

**6) Soil Health and One Health**

**Brevik et al., (2020)**. Soils are recognized for their contributions in areas such as the supply of adequate quantities of nutritious food products, medications, and for their assistance in developing the human immune system. Negative health impacts also occur when foods are grown in soils that have nutrient deficiencies or when people are exposed

to toxic levels of chemicals or pathogenic organisms through contact with soil or soil products. However, there are still many things we do not know about the links between soils and human health. As the global population grows, we will need to produce more food that maintains or enhances its nutrient content on essentially the same land area, assuming we can reverse our current losses of arable land to degradational processes.

**Steffan et al., (2018)** studied the effect of soil on human health states that soil is major source of nutrients to plants so as to humans. The concept of soil security needs special focus and study. Soil also works as filtration medium for waster and supply the clean water. Awareness about the soil is needs to be done in context of reducing these concerned risks. Soil contains the large number of heavy metals, chemicals, insecticides, pesticides and other toxins which has direct and indirect effect on human health.

**7) Environment and One Health**

**Brulle et al., (2006)** studied the human health in terms of environmental inequalities. This study shows that environmental pollution in one of the major contributors in inequalities which leads to many health problems. Environment is integral part of the food system so it plays important role in food security.

**Albering et al., (1999)** studied the two fresh water lakes in the Netherlands to assess the health risk relation and came up with the findings that sediments of the lake contain the heavy metals like polyhydroxyalkanoates. Fish ingest heavy metal and get accumulated in them. These fish enter in food system and causes toxicity to human. The two lakes are cause for the heavy metal toxicity.

**8) Plants and agricultural practices in relation to One Health**

**Rohila, A. K., (2017)** studied the impact of agricultural practices on environment. Water, soil. Air and biodiversity are major components of environment which is altering day by day due to modern agricultural practices. There is requirement National policy for natural farming which will help to make the farming practices sustainable. Total 20% of the Co2 emission is done to various agricultural practices which causes the many health hazards.

**Onder, M., et. al (2011)** studied the effect of agricultural practices on environment. And came up with the findings Modern agriculture practices are making environment polluted due to use of chemical fertilizers, insecticides, pesticides use. These chemicals are entering into food system through plants. These chemicals cause the toxicity to human body. Chemicals used in modern farming causes toxicity to non-targeted animals as well which can be good for human body.

## RESEARCH METHODOLOGY

### Study design

This study is done by doing desk research with duration of two months supported by

google form questionnaire for concerned stakeholders and expert panel discussion.

**Selection of respondents**

Five stakeholders from each category of stakeholders contains Soil Scientists, Progressive Farmers, Medical Officers working in rural area, Public Health Experts and Veterinarians. These are major stakeholders in One Health. To know their awareness and knowledge about one health these respondents are selected. And considering the expertise of individual five experts are selected for panel discussion.

**Data collection-**

- Secondary data was collected by reviewing the already existing articles, research papers, book chapters, newsletters etc from authenticated sources like Google Scholar, Scopus etc.
- Primary data collection was done from the five types of concerned stakeholders, five each with total sample size of 25.
- Primary data collection is done by conducting an online expert panel discussion on Webex platform with five renowned experts.

**Tools and techniques for data collection**

The secondary data is collected from online available authenticated sources like google scholar, Scopus etc. Primary data collected by circulating the google form structured questionnaire amongst all concerned stakeholders. The questionnaire for farmers was constructed in Marathi as all farmers were familiar with this language. And if needed explained them all questions via one-to-one telephonic conversation.

**Data analysis**

The data collected is qualitative one. A wide variety of data was summarised and categorised in different ways for ease of presentation and comprehension.

**Results and Discussion**

There is a need to increase research on zoonoses, food safety, and agriculture and to improve the understanding of the one health concept. Developing countries do lack in infrastructure which affects the human health, well-being and environmental health. (Bidaisee *et al.*, 2014). There is need of transdisciplinary approach towards the spread of zoonotic diseases like covid 19. The One health is only multisectoral approach can be effective in such pandemic situations where the various stakeholders like Public Health Experts, agriculture specialist, veterinarian etc. The world has suffered from the covid 19 pandemic and its consequences. (D. Katterine Bonilla-Aldana *et al.*, 2020). It is clearly saying that protection of human health needs the collaborative approach towards the plant health, animal health and its shared environment. Covid 19 is rising alarm for this.

Threat of zoonotic diseases like covid 19 is very well explained. For the Indian Council of Medical Research and Indian Council of Agricultural Research are coming up with National Institute on One Health in Nagpur. (The Indian Express, 2021).

Incorporation of one health into the education system will help us to improve the awareness about this concept amongst all sectors. There is necessity of same initiative in Indian education system as well. Excessive use of antimicrobials in plants and animals lead to entry of antimicrobials in food chain and becomes a threat to human health. The threat of emerging pandemic is explained with the supportive statistics. The influencing factors for emergence of pandemics are enlisted so that we can bring out the changes by focusing those. Those contributing factors should be divided according to particular stakeholder. This bifurcation will provide the proper guideline for stakeholders to work on. The economic burden of pandemics is explained using statistical figures given by World Bank. Those pandemics between year 1997 to 2007, 80 billion dollars was total economic loss was there and if the prevention was used earlier, it would have cost only 25 billion dollars. Economic evaluation of one health should be discussed and reach to the stakeholders to improve awareness. Many SDGs have linkage with one health, to complete the agenda 2030 the implication of One Health approach is prime requisite (Food and Agriculture Organisation, 2021).

It indicates the need of incorporating One Health Approach in educational curriculum to have knowledge and awareness about it. It will be guiding light for those who are already doing study by interconnecting the plant, animal and human health. This review highlights the need for larger and more controlled comparative studies of one health disease prediction and control strategies. (Peter M *et al.*, 2013). As per discussion above, it's clear that one health approach is necessary for prevention of long-term pandemics like covid 19. The coming threats for all livings beings can be tackled only by incorporating all the concerned sectors together and their joint interventions for same. Importance and need of the hour for one health approach is explained by Director General of FAO in one Planet Summit in Rome.

**Results of Google Form Questionnaire from Concerned Stakeholders.**

Stakeholders were consisting of five Soil Scientist, five Medical Officers working in Rural Maharashtra, five Veterinarians working in Government Institutes, five Public Health Experts currently working in Government projects and five progressive Farmers from rural Maharashtra with total count of 25.

## Responses from Medical Officers

### Qualification and Experience

A review of the data revealed that all of the Medical Officers having MBBS degree, with one of them also completed a Post-Graduation in Doctor of Medicine with a specialization

in Community Medicine. Experience ranges from one and half year to 10 years.

**Opinion of Medical Officers regarding the common prevalence and its causes in their locality**

According to the data, three of the Medical Officers reported that Diabetes was a common disease in their area. Apart from that Dengue, Malaria, Rabies, Tuberculosis, Rickettsia. reported combinedly by others. Along with this lower respiratory tract infection, upper respiratory tract infection, hypothyroidism are also common diseases. Medical Officers revealed that the most common cause of the prevalent diseases in their area was lack of hygiene, lack of awareness about good hand washing practices, environmental issues such as temperature, humidity and domestic rearing of dogs and cats.

**Opinion of Medical Officers regarding the association of human health with plant health, soil health, animal health and environmental health.**

Human consumes plants as food shows its interconnectedness. Soil health is essential for plant growth and development and it eventually aids in the development of human immunity, as we consume plant-derived products. The other Medical Officer responded that soil is the most abundant source of minerals and pathogenic agents, and thus human health is directly linked to plant and soil health.

First Medical Officer explained relationship of human with animals that, with humans rearing animals for livelihood and substantial farming occupation. Mishandling of milk and meat for human consumption has resulted in a source of infection for diseases such as tuberculosis, brucellosis and others. All Medical Officers emphasized that the close association of humans and animals may result in zoonotic diseases in humans.

According to Medical Officers, humans live in an environment, and various factors such as temperature, humidity, and air pollution as well as air pressure play an important role in maintaining human health. Air pollution, sound pollution and water pollution cause a variety of human diseases such as disturbed intestinal health, lung disease, hypertension, stroke, cancers and so on. All Medical Officers agreed on same point.

Rabies, Brucellosis, Rickettsia, Neurocysticercosis from uncooked beef meat ingestion; and Swine Flu (H1N1) from pigs, Toxoplasmosis, Plague Cysticercosis, Echinococcosis, and Japanese Encephalitis are zoonotic diseases listed by Medical Officers.

**Causes of spread of Zoonotic diseases according to Medical Officers**

The data gathered revealed that human-animal interaction in civilized habitats, such as raising pet animals, cats, dogs, livestock breeds are the leading cause of the spread of zoonotic diseases. Coughing, sneezing, and touching infected bacteria, viruses, or fungi can all lead to disease transmission. All Medical Officers agreed on, working in close

proximity to infected livestock, contact with infected animals and pets, unpasteurized dairy product consumption, contact with animal-contaminated soil and water inadequate hygiene maintenance are causes.

**Suggestions of Medical Officers to control the spread of Zoonotic diseases**

According to the findings, raising awareness about zoonotic diseases among all citizens of the country, training of all stakeholders is carried out, teaching them how to control and avoid zoonotic diseases. Regular vaccinations and animal hygiene to control the spread of zoonotic diseases. To control the spread of diseases, use gloves, hand wash, mask, do not eat or drink in animal handling areas, avoid going to farm and animal areas if you are sick, care and treatment of sick animals consult doctor if there are sick animals as suggested by the third, fourth and fifth medical officer respectively.

**Awareness of Medical Officers about One Health approach**

The data revealed that 60 percent (i.e., 3 Nos.) of the Medical Officers were aware of the One Health approach, whereas 40 percent (i.e., 2 Nos.) were not.

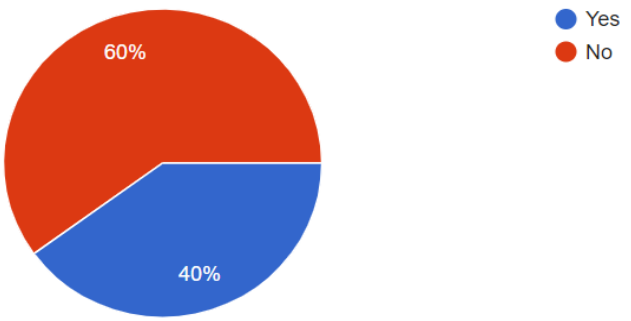


**Fig.1. One Health Appraoch**

**Views of Medical Officers on One Health approach**

The Medical Officers who were aware of the One Health approach stated that training and certification of stakeholders should make mandatory about one health.

## Responses from Veterinarians

**Qualification and experiences**

A review of the data revealed that all of the veterinarians had a Master's Degree in Veterinary Sciences. The Veterinarians experience ranged from six years to ten years.

**According to Veterinarians following animals have more potential to spread zoonotic diseases.**

The Veterinarians emphasized that dogs, cats, monkeys, rodents, wild animals have more

potential to spread zoonotic diseases.

**Suggested management practices to control the Zoonotic diseases by Veterinarians**

Vaccination of animals and raising public awareness through the use of various extension tools. Following strict biosecurity protocols on the farm, rodent control in residential areas, and following self-care routines while handling animals were the other major recommendations made by the veterinary doctors.

**Observed trend of Zoonoses by Veterinarians**

All the veterinary doctors unanimously agreed that there has been an increase in the number of cases related to zoonotic diseases among the human beings.

**Opinion of Veterinarians on relation of animals with human health and plant health**

Veterinarians emphasized that plant health affects herbivore nutrition; if an animal consumes bad plants, the likelihood of zoonotic diseases affecting human health increases. According to all Veterinarians, sixty percent of diseases are transmitted by animals, so if plants are healthy, we get healthy animals, and if animals are healthy, we get healthy humans, and vice versa.

**Awareness of Veterinarians about One Health Approach**

The data revealed that all of the Veterinarians were aware of the One Health concept.

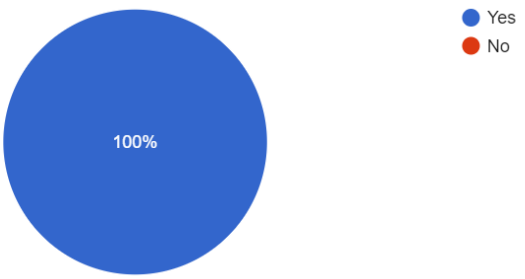


**Fig.2. One Health Approach**

**Connection of animal health with human health according to Veterinarian**

The Veterinarians stated that, most diseases shared by both animals and humans are transmitted amongst themselves, controlling disease only at the human or animal level does not help with disease control. Many diseases are transmitted from animal to human, and vets should share knowledge about their treatment, control, and diagnostic tests with medicos. Importance of raising awareness about veterinary public health. As a result, it is time to consider both human and animal health in terms of disease prediction and control. It is only possible if both the veterinary and medical fields work together. Then there will be only One Health.

### Suggestion and recommendation of Veterinarians on One Health

Collaboration in Veterinarians and Medicos should happen and there must be constant knowledge sharing sated by all Vets and combinedly they should involve in One Health.

## Responses from Public Health Experts

### Qualification and experiences

Data says that 2 out of 5 experts are holding a Master's degree in Public Health and Other three are PhD holders in Public Health with experience ranging from five to twenty-five years.

### Opinion of Public Health Expert on association of human health with plant health

The Public Health Expert stated that the rise in diseases, deforestation, global warming, and contamination of water and soil have all had a negative impact on human health. The all expert emphasized that we consume plants and thus consume chemo as well as other harmful substances that plants carry. Fertilizers, pesticides, or diseases could all be to blame. Chemical leaching into soil has an impact on plants and thus on us.

### Opinion of Public Health Expert on association of human health with animal health

According to all experts, the animal health is associated with human health, as it has relation with the food chain and zoonotic diseases.

### Opinion of Public Health Expert on association of human health with environmental health

According to experts, deteriorating environmental health and rising pollution are causing a slew of NCDs as well as Global Warming and Cancer. Unhealthy environments make it even more difficult to practise healthy habits. Other experts agreed that pollution, imbalance with nature, and the increased frequency of catastrophic climate events all have an impact on us.

### Possible reasons for pandemics like Covid19 according to Public Health Experts

Public health measures are not being implemented due to a lack of awareness. Prior actions had not been taken, increased global interconnectedness, organisms crossing the animal-human barrier, animal origin of disease, and a lack of a mindful development agenda are some of the major possible causes of pandemics like COVID19. The experts also stated that Covid19 is thought to be a Zoonotic disease. Environmental pressures on mammals may result in more ambiguous interactions between certain animal species and humans, potentially leading to pandemic outbreaks.

### Measures suggested by Public Health Experts for safeguarding the Human, Animal, Environmental and Plant Health

Understanding of how each has an impact as well as their interaction and interdependence approach that is multidisciplinary. Increased comprehension and awareness as well as responsible consumption. Public Health Experts recommended strengthening health systems at the human-animal-environment interface, sanitation, improving immunity, peaceful coexistence and reducing carbon footprint as some of the major measures for protecting human, animal, environmental, and plant health.

**Awareness of Public Health Experts on One Health Appraoch**

The data revealed that all of the Public Health Experts were aware of the One Health concept.

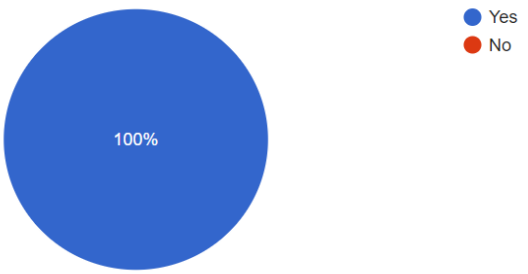


**Fig.3. One Health Appraoch**

**Views of Public Health Expert on One Health Approach**

The experts mentioned an approach that takes into account inter- and trans-disciplinary approaches. A multi-faceted approach that will benefit everyone.

**Different stakeholders of One Health listed by Public Health Experts**

Departments of Public Health, Animal Health, Animal Husbandry, Agriculture, Research Institutes, International Organizations and Professional Bodies involved directly in environmental protection are examples of specific sectors.

**Opinion of Public Health Experts on implication of One Health Approach**

Proper implementation of the One Health approach will contribute to increased awareness and comprehension. It will aid in gaining a better understanding of human, animal and environmental health. Health awareness will rise among stakeholders as a result of everyone working together to improve global health.

## Responses of Soil Scientist

**Qualification and Experience**

A review of the data revealed that all the Soil Scientist sampled were having Ph.D., in Soil Science. The experience ranged from four to thirty years.

**Soil Health indicators and parameters listed by Soil Scientist**

The Soil Scientist mentioned the pH, EC, SOC, MBC, BD, available nitrogen, phosphorus, and potassium, available micronutrients and dehydrogenase activity as soil health parameters and indicators. Soil health parameters include soil physical, chemical, and biological properties that influence fertility, productivity and produce quality. The (soil health) indicators are critical soil health parameters that have an impact on soil health and can be easily measured.

**Opinion of Soil Scientist about change in soil parameters**

If unsustainable anthropogenic activities are not carried out in tandem with soil health parameters, soil health will deteriorate. Except for BD, pH and EC, all other parameters change over time as a result of management intervention. Depending on the climatic condition and moisture content in the soil, different parameters will change at different times. Management practices, cropping pattern, and climate were some of the major causes of soil health parameters that change with time.

**Association of soil health and human health according to Soil Scientist**

The Soil Scientist stated that the following reasons for soil health affect human health: Excessive nutrient mining of soils for production has harmed human health through a variety of deficiencies over the years. Soil health is linked to human and animal health because healthy soil produces nutrient-rich produce. Good health is provided by healthy soil. Because it adds nutrients to our food. Soil health has an impact on human health by influencing produce quality, nutritive value, and pathogen incidence. The nutrient content of food is determined by the type of soil in which it is grown.

**Effect of soil health on plant health according to Soil Scientists**

The Soil Scientist mentioned that plant health is improved by management practices that balance soil health parameters. The degradation of any one soil health parameter can have a negative impact on plant health. For example, Liebig's Law of Minimum allows us to understand how a deficient element can affect crop biological produce. Healthy soil produces healthy plants, implying that soil health influences plant health, influencing plant growth, productivity and produce quality.

**Effect of soil health on animal health according to Soil Scientists**

The quality of feed and fodder produced in soils with good or poor soil health has a direct impact on animal health. Human and animal health are intertwined because a healthy soil produces nutrient-rich produce, which in turn affects human and animal health. Depending on the nutritive value and pathogen intensity, the plant produces that animal consume will have an impact on their health. The soil type determines its food availability and environment.

**Opinion of Soil Scientist on effect of soil health on environment health**

Management practices that are beneficial to soil health will have a positive impact on environmental health, whereas activities that violate soil health parameters will have a negative impact. Pollutants are buffered by soil. It protects ground water from pollution by filtering pollutants. It also sequesters CO2 from the atmosphere, lowering CO2 concentrations in the environment. Healthy soil ensures the long-term viability of ecosystems. Soil health is critical to improving environmental health. Polluting the water and environment will result in unhealthy soils, and the type of vegetation is determined by the soil and climate.

**Awareness of Soil Scientist about One Health approach**

The data revealed that only three of the five Soil Scientist were aware of the One Health approach.

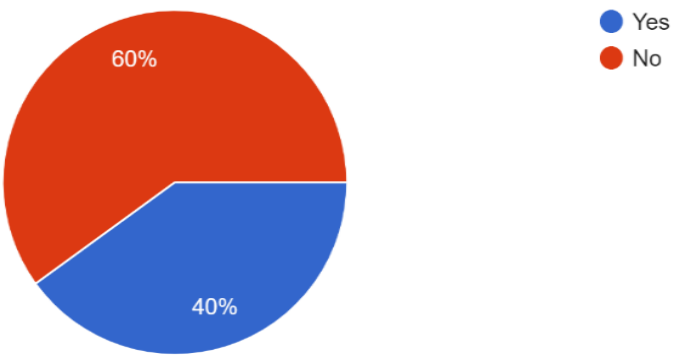


**Fig.4. One Health Appraoch**

**Recommendation of Soil Scientists on One Health Appraoch**

The Soil Scientist recommended that there is a need to develop an integrated index that includes soil, human/animal and environmental components to help sustain soil health, nourish the soil and save the environment.

## Responses from Farmers

**Experience**

The farmers' years of experience ranged from ten to twenty years.

**Qualification**

Out of five, 3 farmers are $10^{th}$ pass and one is having diploma in Electrical Engineering and other one is $12^{th}$ pass.

**Common diseases listed by Farmers in plants and animals**

The farmers stated that the most common diseases found in plants and domesticated animals were Query Fever, Foot and Mouth Disease (FMD), Rabies in animals and bacterial diseases in plants.

**Reason for the common diseases explained by farmers**

Contaminated food and water sources and the use of heavy chemical fertilizers in field practices as well as a lack of natural and organic farming; Diseases in animals caused by not vaccinating them on a regular basis as well as climate change Plant diseases caused by viruses and hot, humid weather; Pollution and climate change are also major contributors to rising disease incidences; Plant diseases caused by climate change and excessive use of chemical fertilizers and Animal diseases caused by a lack of cleanliness in their shelter as well as communication diseases.

**Possession of Soil Health Card**

All the sampled farmers mentioned that they didn't possess Soil Health Card.

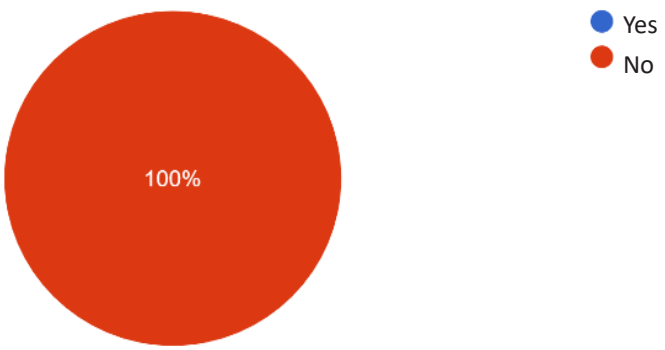


**Fig.5. Soil Health Card**

**Agriculture practices followed by Farmers**

Two farmers each practiced modern farming and mixed farming, respectively, while the remaining farmer practiced traditional farming.

**Relationship between plant, animal, humans and environmental health according to Farmers**

Majority of the farmers (80%) agreed that there was a relationship between plants, animal and human health while the remaining 20 percent didn't agree to this relationship.

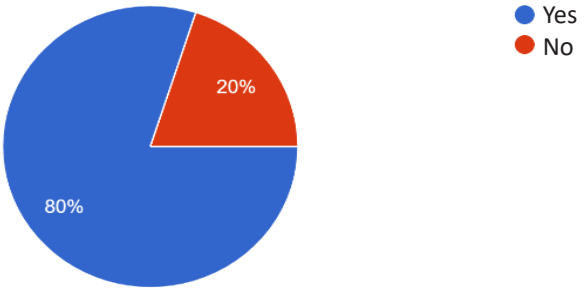


**Fig.6. Relationship between plant, animal and human health**

**Health issues listed by Farmers in their community**

Cancer, respiratory diseases, blood pressure, B12 deficiency, Covid19 deficiency, viral fever, diabetes and heart disease were the most common health issues reported by farmers in their surrounding community.

**Farmer's Opinion about Consultation from Doctors**

Majority of the farmers (80%) agreed that they consulted doctors for their health issues while the remaining 20 percent didn't consult any doctor.

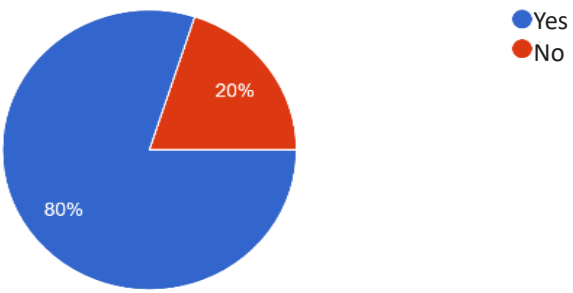


**Fig.7. Consultation from Doctor**

**Treatment given by doctor according to Farmers**

Besides, general medicine advice such as drinking plenty of water and eating healthy foods, doctors' most common line of treatment was symptomatic treatment.

## Important Findings from Expert Panel Discussion

Expert panel discussion was held on online Webex platform with structured leading questionnaire. The five renowned experts were there in panel included Prof. Anil K. Gupta, Executive Vice Chair, National Innovation Foundation, Ahmadabad

Prof. Pasala Geervani, Former Vice Chancellor of Sri Padmavathi Mahila University, Tirupati; Dr. S. B. Barbuddhe. Director, National Research Centre on Meat, Hyderabad and one of the core members of One Health Consortium; Prof. Sandeep Chaudhari, Department of Veterinary Public Health and Epidemiology, MAFSU, Nagpur and founder member of National Institute on One Health, Nagpur; Dr. Ram, Visiting Faculty, MIT-World Peace University, Pune is an experienced public health expert along with ayurveda graduate.

**Importance of One Health Approach**

Soil resilience is integral part of one health, it is a highly valuable living medium and soil health which comprises of micro and macro-organisms present in soil, micronutrient profile leads production and productivity of soil. More focus is needed with respect to study healthy animal, healthy individuals and healthy plant. One health aspect should be focused, because health expenditure per family is increasing day by day. Public health system needs to be improved and awareness about healthy practices should be made amongst parents and children. Water is important nutrient which plays important role in health and is the first things affecting the health. Healthy hygiene and sanitization practices should be done to reduced infections. Combine research is necessary by all concerned stakeholders. Need of strengthening the public health system. Livestock raising needs to be practiced in scientific way. Increase in zoonotic diseases led to think on one health approach. Mental health also one of the aspects in One Health. There is need to sensitize and mobilize stakeholders to make common platform to work on One Health.

**About the stakeholders of One Health**

1. Theoretically, everyone is stakeholder in one health
2. Soil Scientist
3. Medical Practitioners
4. Public Health Experts
5. Veterinarians
6. Environmental Scientists
7. Wildlife Experts
8. Human Nutritionist
9. Metallurgists
10. Food Technologists
11. Food safety and quality control experts
12. Farmers

13. Sociologist- Role in convincing people.
14. Administrative and legal stakeholders
15. Technologists

**Role of MANAGE in One Health**

1. Capacity building of stakeholders.
2. Offering the Diploma or short educational courses.
3. Curriculum development for other educational institution.
4. Innovative approaches need to be practiced to create wide spread awareness among the stakeholders in Agri-allied sectors.
5. Linking and sharing of information among the stakeholders on one health at various level for better collaboration.
6. Conducting comprehensive action research on One Health.

**Researchable areas in One Health**

1. Disease burden and surveillance.
2. Scope of genomics in one health
3. Antibiotic resistance.
4. Food safety and nutrition
5. Climate change and One Health.
6. Occupational hazards and one health
7. Mental health and One Health.
8. Research on the triple burden on human health
9. Area specific study is necessary for better implementation.
10. Health map of India is necessary for area specific study.
11. Change in disease trend and immunological responses to pathogens needs to be studied.

## Conclusion

**Researchable areas found in Review of Literature on One Health for different Stakeholders-**

1. Chronology and pathway of various zoonotic diseases.

2. Forecasting and preparedness of pandemic outbreaks.
3. Study on abiotic factors responsible to guard One Health.
4. Surveillance and understanding spread of emerging diseases.
5. Study on antimicrobial resistance and thereby economic burden on farm family.
6. Mutation in pathogens in view of climate change.
7. Study on exploring stakeholders and their intersectoral collaboration in One Health.
8. Impact of air, water and soil pollution on various agriculture crops.
9. Study on emergence of pathogens in view of climate change.
10. Study on role of indoor plants to improve environmental health and thereby human health.
11. Study on effect of agricultural practices on environment.

**Researchable areas found in Stakeholders on One Health for different Stakeholders**

1. Study on consequences of human and animal interaction in civilised habitat
2. Study on factors affecting drug resistance and lowered antibiotic sensitivity w.r.t. genetic profile
3. Study on role of extension/sociologist in making awareness one health
4. Study on eco-friendly agricultural practices.

**Researchable areas found in Panel Discussion on One Health for different Stakeholders**

1. Study on chemicals present in soil
2. Study of healthy individuals should be done for the assessment of factors responsible for their healthy life
3. Study on gene therapy and advanced technology to safeguard one health
4. Role of water in human health
5. Soil health mapping
6. Study on healthy cooking practices
7. Study of healthy plant, animal and human plasma for mapping of micronutrient profiles

8. Study on source of contaminations food, water, environment etc.
9. Study on health map of India

## Recommendations

1. Identification of stakeholders and defining their role in One Health.
2. Policy interventions on One Health.
3. Sector specific intensive research and documentations on One Health.
4. Development of common platform for all stakeholders to share information and line of action.
5. Application of ICT and social media to create awareness about One Health.
6. Incorporation of one health approach in early educational curriculum to create awareness.
7. Incorporation of one health approach in higher educational curriculum to discover dimensions of One Health.
8. Capacity building of stakeholders on One Health.
9. Study on global experiences in safeguarding One Health.
10. Study on grassroot level awareness about one health among the stakeholders.
11. Study on innovative methods to achieve One Health.

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# ‘CHURPOON’ an Indigenous and Sustainable Water Management System in Cold Arid Ladakh

**Parveen Kumar[1], Sonam Angchuk[2] and D. Namgyal[3]**

## ABSTRACT

*The Union Territory of Ladakh is characterized by a very fragile ecosystem and scarce natural resources. Agriculture here is confined to six months in a year owing to the extreme freezing temperatures which do not permit any agricultural activity in the harsh winters. The water for irrigating crops comes from the melting of snow and glaciers in summer season. The availability of this water depends upon the amount of snowfall that had occurred in the previous winter. Locals have also reported witnessing a decline in snowfall over the years. As such, the water has to be used very judiciously. This is also because of the climate change and shift in precipitation patterns. Communities in the Ladakh region have developed various institutional models for conservation of its natural resources. The present review article deliberates upon an indigenous and sustainable water management system the* ‘Churpoon’. ‘Churpoon’ *in the local language is used for the water supervisor, who leads the group of these water managers. These water managers are entrusted with the responsibility of irrigating the fields of the whole village judiciously.*

**Keywords:** Churpoon,Irrigation, Natural Resources, Water Management, Indegenous Technologies, Ladakh

## Introduction

Water is an indispensible natural resource that has wider application in our households, in agriculture, for livestock and almost in all sectors of economy. India accounts for about 17% of the world’s population but only 4% of the world fresh water resources (Dhawan, V. 2017). Out of which 80% is used in agriculture. However, only 48% of it is used in India’s surface and groundwater bodies. The average annual per capita water availability in the years 2001 and 2011 was assessed as 1816 cubic meters and 1545 cubic meters respectively which may further reduce to 1486 cubic meters and 1367 cubic meters in the years 2021 and 2031 respectively leading to far less water availability for

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agriculture (PIB). The water availability for agricultural use has reached a critical level as the country uses more than 80 per cent of the surface water for this sector alone. On the other hand, inefficient and dilapidated canal irrigation systems have led to a spurt in groundwater development. India is the largest user of groundwater in the world with over 60 per cent of irrigated agriculture and 85 per cent of drinking water supplies dependent on aquifers (World Bank, 2012). The 2011 census put India into a league of water deficient nations. A country is considered to be water deficient if the per capita availability falls below 1700 cubic meters per person (Kumar, P. 2020). Although the rate of depletion of this precious resource has gone down in the country but still it is not at par with the rate at which it is being replenished in the nature. As per the Central Water Commission, 85.3 per cent of the total water consumed was for agriculture in the year 2000 and it is likely to decrease to 83.3 per cent by 2025. Unless and until efforts are being made to conserve water, we are not going to do good for our coming generations. The country has to spend more on water conservation particularly in agriculture sector.

Ladakh region of the country being a very ecologically fragile region have developed various institutional models for conservation of its natural resources. Agricultural in this region is confined to six months in a year owing to the extreme freezing temperatures which do not permit any agricultural activity in the harsh winters. In this dry desert of Ladakh, farmers depend on water from melting snow and glaciers (Parveiz, A. 2018). Further the availability of this water to be used for irrigation depends upon the amount of snowfall that had occurred in the last winter season. As such the water has to be used very judiciously. This judicious use of this scarce resource is also necessary because of the climate change and shift in precipitation patterns. Locals have also reported witnessing a decline in snowfall over the years. The present review article deliberates upon an indigenous water management system the 'Churpoon' prevalent in the cold arid region of Ladakh. 'Churpoon' in the local language is used for the water supervisor, who leads the group of these water managers. The '*Churpon'* as a leader of the group has all important roles to play in ensuring judicious use of this resource.

**Locale of the Study:** The study has been done purposively in the selected villages of Leh district where this institutional arrangement for judicious use of water is still in practice. The four villages selected were Phey, Saboo, Matho and Stok.

**Research Methodology:** The information regarding this traditional water management system was collected from three 'Churpoon' and ten members from their respective teams. The information was collected through direct personal interviews in a face to face situation and that has been summarized under Results and Discussions.

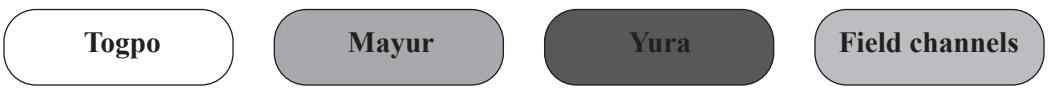
**Results and Discussions:**

'Churpoon' is the traditional institutional arrangement, a participatory social networking mechanism that ensures timely and equitable supply of water to all the farming community

of that particular area. '*Churpoon'* in the local language is used for the water supervisor, who leads the group of these water managers. The 'C*hurpoon'* as a leader of the group has all important role to play in ensuring judicious use of this resource. Appropriate time slots and durations depending upon the land availability with the individual farmers have been allocated and made in this system. At the same time the system has an inbuilt system of sanctions also for those who defy the set procedures.

**a. The irrigation network:**

The ice water that melts and gets collected in various small rivulets is locally called '*Kangs-chhu'*. This *kangs-chhu* sometimes merges together and form a stream locally called *as 'Togpo'*. This '*Togpo'* flows through many villages connected by a main channel called *Mayur* (mother channel). This mother channel is built along a mountainside that forms its retaining wall and it is lined with clay to hold the water. From the main channel, the water is further diverted into small canals locally called as *yura*, which irrigates the fields. The point from where water from the stream is diverted into main channel and from main channel to small channels called *yurgo*. The point from where water from the yura is diverted into the field is locally called as *Ska.* Water in the *Ska* is further guided through channels known as *snang*, which carry the water throughout the field. Some variations can be found in the local names in different parts of the region.




**b. Rotational system of water allocation:** The system of water allocation to the inhabitants of the villages falling within the jurisdiction of a particular '*Churpoon'* is largely a rotational one. It is prepared based on the acreage under cultivation, the topography, the amount of precipitation, the size of glacier and the soil type of the village. In small villages it is fairly easy to arrange whose field will get water according to the rotational system. In a village where distribution is arranged by channels, the field lying along the given channel is irrigated in order of the gradient are irrigated first. In the rotational system, monitoring/surveillance appear to be the most significant element. Because village affiliation is a lifetime sentence, the ignomity of being caught cheating may provide a sufficient deterrent to abuse within the system. However, as the village becomes large, more and more anonymous, and more influenced by a cash economy, anomic situation is increasing, especially in and around Leh.

***c. Churpoon:*** **the water supervisor:** The word 'C*hurpoon'* means 'Lord of the water', derived from '*Chur'* meaning water and '*Poon'* meaning Lord. Water supply to all is supervised by this '*Churpoon'*.

**i. Prerequisites for a '*Churpoon':*** Male members are considered for '*Churpoon'*. He is selected by the villagers as in charge of water distribution for irrigation and is perhaps the most important functionary in this regard. The *Churpoon* is expected to consider the fields of whole village as his own and to know the order in which water is to be distributed to a particular crop in what quantity and when. He should also know how to preserve water in times of scarcity.

**ii. The lucky '*Churpoon'*:** If there is sufficient precipitation (snowfall) during the term of a *Churpoon,* than he is considered to be a Lucky "***Churpoon'.*** A person of these qualities was selected by consensus in earlier times. Nowadays rotation system is prevalent in most of the villages. One can find such an arrangement in almost every village except in villages where water is in abundance and there is no need for its judicious use or management. In villages where water is a scarce quantity, there are even more than one ***'Churpoon'.***

**iii. The tenure:** The term of a '**C*hurpoon'*** may vary from a cropping season to three or more years. For their service they are paid in kind or cash. In kind they are given *so-nyom* (one man load of cereal crop with some variation region wise) after the harvest of crop. When it is in cash, they are provided according to the quantity of land the household possess and have been irrigated by them. The larger the area the greater amount/quantity they get. It also varies for 100 to 500 per household depending on the size of landholding. In the villages where water scarcity is a major problem, the main canal is also guarded by them on a rotational basis and sometimes they have to sleep there too.

**d. The Worship:** To pay regards and show their respect to the water, usually at the start of this irrigation practice for a season, the Churpoon along with the *Lama ji* (Buddhist Priest) and his team go to the mountain top or the glacier from where the water melts down for the traditional worship. It is also a belief that during stopping or releasing water from *mayur* to the *yura* the '*Churpoon'* has to keep his *Goncha* (long overcoat) at ankle length and cannot tuck it into his belt as is often done while working. The C*hurpoon* is supposed to distribute water according to the rotational system

**e. *Chuu-tsir* (the order of irrigation):** The amount of precipitation in the winters in this cold arid region determines supply of water during the following summer season. Another factor is the state of weather in the months of March-April. Dry sunny weather enhances the melting of snow and thus the water supply starts early and gets delayed if the weather is cloudy. This ultimately has a bearing on the time of ploughing and sowing operation in the region.

***a. Thachus* (I$^{st}$ irrigation):** Fields are irrigated for the last time in autumn after the soil is ploughed when harvesting of crop has been done. This first irrigation is called '*Thachus'* in local language.

***b. Dolchu* (2nd irrigation):** The second irrigation done after sowing of crops is called as '*Dolchu*.'

***c. Sragchu* (3rd irrigation):** The third irrigation is called as '*Sragchu'* and is done when the crops reaches at knee height stage

***d. Nonchu: (Last irrigation):*** The last irrigation done prior to harvesting of the crop is called as '*Nonchu'*.

| Indigenous name | Meaning |
|---|---|
| *Churpoon* | Water Supervisor |
| *Kangs-chhu* | Small rivulet |
| *Togpo* | Stream |
| *Mayur* | Mother Channel |
| *Yura* | Small Channels |
| *Snang* | Small field channels |
| *Yurgo* | Point from where water from stream is diverted to main channel |
| *Ska* | Point from where water from main channel is diverted to small channels |
| *Lung* | Fields |
| *Tokchu* | Stream |
| *Thachus* | First irrigation |
| *Dolchu* | Second irrigation |
| *Sragchu* | Third irrigation |
| *Nonchu* | Last irrigation |

## Conclusion

Water constitutes a critical input for raising crops in this Trans-Himalayan cold arid high altitude region of the country. Unfortunately most of water gets wasted because of the lack of required arrangements and water use institutions for their judicious use. In this regard, the institutions like '*Churpoon'* are still playing an active role in ensuring timely and equitable distribution of water to villagers for irrigating their fields with minimal conveyance losses. The *Churpoon* (water supervisor) along with his team has the responsibility to ensure water availability according to the mutually agreed pre-decided order. Such institutional arrangements are time tested, sustainable and resource conserving. These need to be regulated and recognized with also some monetary support from the local government. Such arrangements also need to be out scaled and replicated in other regions. Government can also provide funds under Mahatma Gandhi National Rural Employment Guarantee Act to repair the existing or build new network of canals

for carrying water to fields more efficiently and effectively from head to tail. With the engagement of communities in the implementation process, the need for government support gets minimized considerably and this also makes this arrangement self-reliant and socially sustainable.

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# A Study on Climate Resilient Rice Varieties on Productivity Enhancement under Direct Sown Rainfed Ecosystem

**P. Arunachalam[1] and T. Ragavan[2]**

## ABSTRACT

*The Ramanathapuram district farmers are practicing North East Monsoon rain dependent semi-dry rice cultivation. The climatic vulnerability of pre-monsoon and intermittent dry spells are major constrains in crop husbandry practices and to harvest remunerative grain yield in semi-dry rice. The Krishi Vigyan Kendra, Ramanathapuram had demonstrated five climate adapted rice varieties to 82 farmers at an area of 31 hectare. The short duration rice varieties namely CO 53, ADT 53 and CO 51 matured in 110 days with grain yield advantage of 35, 20 and 16 percent respectively than conventional variety. If there is no terminal drought or the tank-fed rain water availability is not limited the mid-early rice varieties namely TKM 13 and RNR 15048 gives an average grain yield of 5755 and 5371 kg/ha respectively. Apart from adopting suitable rice varieties, the other main reasons for enhanced grain yield is use of certified seeds ensured good population stand under pre-monsoon dry seeding and nutrient management practices. The extension gap in rice varieties studied ranged from 690 to 1585 kg/ha and technology gap is from 825 to 1179 kg/ha. The benefit cost ratio (BCR) in conventional varieties was 1.72, and in improved rice varieties ranged from 2.01 (CO 51) to 2.25 (TKM 13). Hence concerted extension efforts are needed to ensure adoption of improved technologies on wider scale. The technology index showed Co 53, ADT 53 and TKM 13 has more feasibility to adapt varied soil and climatic variability of this region.*

**Keywards:** Extension Gap, Rice, Rainfed Agriculture, Rice Varieties, Dryland Agriculture, Direct Sowing

## Introduction

Ramanathapuram District is located in the Southern part of Tamil Nadu State between 9° 05’ and 9° 50’ of North Latitude and 78° 10’ and 79° 27’ of East Longitude on the East Coast of India. The annual rainfall in Ramanathapuram, district is 827 mm of which 60 percent of rainfall received in North East Monsoon. The major irrigation for agricultural

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crops is rainfed tank water dependent. The use of ground water in this district is limited for irrigation due to high salinity. The farmers are growing rice crop to an area of 187711 ha (Season and Crop Report 2020) under rainfed condition mainly from Ramanathapuram and Sivagangai districts during September to January.

The rice cultivation in Ramanathapuram and Sivaganga districts are encountered with plenty of practical constrains *viz*., i) Rainfed dependent rice cultivation and salinity of ground water ii) Pre-monsoon dry sowing of rice and delayed onset of monsoon results in early crop failure, iii) intermittent drought / flood due to varied intensity of rainfall iv) Rain-dependent intercultural operations limits timely operations of thinning and planting, weeding, fertilizer applications v) non-adoption of climate resilient improved rice varieties, conventional varieties grown in this locality are prone to pest and disease built-up due sudden weather changes in the coastal areas etc. In these circumstances, the average productivity of rice in Ramanathapuram and Sivaganga districts lies 2526 kg/ha and 2654 kg/ha respectively as compared to Tamil Nadu average productivity of 3641 kg/ha (Season and Crop Report, 2020). Hence, the Krishi Vigyan Kendra (KVK) Ramanathapuram aimed to demonstrate climate resilient rice varieties of short duration with drought tolerance, slender rice with medium duration varieties for high market price.

## Methodology

**Demonstration of rice varieties:** The rainfed adapted with short and medium duration rice varieties *viz*., CO 53 (115 days), CO 51 (110 days), ADT 53 (115 days), TKM 13 (130 days), and RNR 15048 (125 days) were demonstrated under NICRA scheme by Krishi Vigyan Kendra, Ramanathapuram. Pre-monsoon direct sowing of rice was taken by the farmers during second fortnight of September 2020. Prior to sowing and during cropping period training programmes were organized on agronomic management of rice in rainfed condition. Large scale demonstrations in 31 ha were done at 82 farmers' fields of *Komboothi* and *Karukathi* villages at Thirupulani block.

**Soil and Climate:** The soil type is sandy clay loam with pH of 8.2. The rainfall received during the cropping season was 836 mm as against normal rainfall of 552 mm. The dry spell was occurred during 3$^{rd}$ to 25$^{th}$ of October with 52 percent deficit at seedling stage of rice. Likewise, an extreme occurrence of 74 percent higher rainfall also happened during November 2020 with 359 mm as against 206 mm.

**Data collection and Analysis:** During harvest the grain yield in terms of number of bags (65 kg per bag), and area raised by the individual farmers were collected. The range, mean of grain yield was analysed individual variety. The individual rice variety wise net return, B:C ratio of demonstrations were worked. The yield obtained in improved rice varieties were compared with the local check i.e bold seeded conventional rice variety *Jothymattai*. The extension gap, technology gap and technology index were estimated by the formulae (Yadav *et. al.* 1999) given below:

Extension gap = Demonstration yield – Check yield

Technology gap = Potential yield (Pi) – Demonstration yield (Di)

Technology index (%) = (Technology gap / Potential yield) x 100

## Findings and Discussion

**Performance of Rice varieties:** The average yield performance of short duration rice variety ADT 53 in rainfed condition was 5035 kg/ha which records 20 percent yield increase followed by 4891 kg/ha (16 percent) in CO 51 as compared to conventional bold varieties like *Jothimattai* and *chitrakar* (Table 1). Pushpa *et. al.* (2020) reported that, ADT 53 variety recorded an average grain yield of 6334 kg/ha which was 9.4 per cent higher than ADT 43 and 14.0 per cent over CO 51. Whereas short duration and drought tolerant rice variety CO 53 recorded grain yield of 5475 kg/ha with 35 percent higher yield over conventional varieties. The mid-early rice varieties TKM 13 and RNR 15048 though it matures in 125 to 130 days and recorded average grain yield of 5755 kg/ha and 5371 kg/ha respectively, if there is no terminal stress or the tank-fed rain water availability is not limited. On large scale testing the TKM 13 variety has recorded a overall mean grain yield of 5938 kg/ha in 159 locations which was 6.2 and 10.1 per cent increase over the check varieties CO (R) 49 (5592 kg/ha) and BPT 5204 (5390 kg/ha) respectively (Banumathy *et. al.* 2016).

Pre-monsoon dry seeding is common practice in Ramanathapuram and Sivaganga districts prior to onset of North East monsoon (Sep.-Dec.). Often, insufficient initial showers during monsoon period compel the farmers to take-up re-sowing which led to additional expense to farmers. The certified seeds used in these demonstrations assisted to withstand the seed viability for 20 to 25 days ensured more germination percentage even in delayed rainfall helped to ensure optimum plant population. Uniform germination, early seedling vigour in drought tolerant rice varieties assisted to overcome seedling stage dryspell upto three weeks. The improved varieties namely CO 53 and TKM 13 were overcome moisture stress at early seedling stage occurred during October 2020. Yamane *et al*. (2017) reported that drought resistant cultivars bred for direct seeded rice (Rc348 and Rc192) had faster germination and sprout growth than popular irrigated rice cultivars (Rc222 and Rc10) under soil water deficit due to rapid moisture acquisition by the germinating seeds from drying soils. Moreover, except initial dryspell the high and periodical rainfall during 2020 also helped to obtain more yield compared to previous years under rainfed condition.

**Economic benefit:** The know-how through training programmes on rainfed rice technologies like use of quality seeds and choice of improved varieties, do-how on micro nutrient and major nutrient management helped to enhance the grain yield. The medium slender to fine grain quality rice varieties gave added benefit of enhanced market price for produce than bold seeded rice variety (CO 53). The economic benefit obtained through

different varieties given in Table 2. The economic benefit of climate resilient improved rice varieties over conventional bold rice varieties ranges from Rs. 30,159 (CO 51) to Rs. 39,287 (TKM 13). The benefit cost ratio (BCR) in conventional varieties is 1.72 and in improved rice varieties ranged from 2.01 (CO 51) to 2.25 (TKM 13). Hence concerted extension efforts are needed to ensure adoption of improved technologies on wider scale.

**Extension gap:** The extension gap was observed with grain yield of rainfed rice varieties from 691 kg/ha (CO 51) to 1555 kg/ha (TKM 13) over conventional rice variety. This increased grain yield is mainly due to intervention of short duration, drought tolerant and improved rice varieties suitable for direct seeded rainfed condition. Hence awareness among the farmers is needed on location specific varieties.

**Technology gap:** The farmers cultivated improved varieties along with land and crop management technologies which resulted with higher yield of 6150 to 7150 kg/ha. It implies that still technology gap is existed in maximizing yield potential ranges from 825 kg/ha (CO 53) to 1779 kg/ha (RNR 15048). Hence, field demonstrations and skill building are required on crop husbandry practices to maximize the rice productivity under rainfed situation.

**Technology index:** Technology index can also be used as an indicator of feasibility of growing the varieties under real farming situation. Lower the technology index more is feasibility of growing the varieties (Barma *et. al.,* 2018). Hence under rainfed situations, the varieties namely CO 53 (13 %), ADT 53 (18 %) and TKM 13 (15 %) showed more feasibility to overcome soil and climatic variations. The expression of genetic potential of improved varieties is the function of growing environment and management practices, the location specific varieties are more important to achieve maximum yield. In farmers field demonstrations, the varieties suited to direct seeded rice and adapted to rainfed environment were chosen, hence the low technology index ranged from 13 to 25 percent was estimated in these varieties.

To show case the yield potential of rice varieties under rainfed condition, the field days and harvest festivals were organized with the participation of Scientists, Farmers and NSC officials. Hailu *et al.* (2017) found the effectiveness of field days was considerably improved due to the improved training packages hence willingness to adopt or continue the technology uptake was significant. It was evident that, the widespread of any technology and its adoption always needs “seeing is believing” concept to motivate the farmers to convert them as adopters rather than mere spectators.

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**Table 1: Grain yield performance of improved rice varieties under farmers' demonstrations**

| Rice variety | Demo (82 No.) | Area (31 ha) | Grain yield (kg/ha) | | | Increased yield (%) |
|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Mean | |
| TKM 13 | 10 | 3 | 4063 | 6771 | 5755 | *37* |
| RNR 15048 | 28 | 10 | 3900 | 7150 | 5371 | 28 |
| ADT 53 | 14 | 8 | 2528 | 6150 | 5035 | 20 |
| CO 51 | 19 | 6 | 2925 | 6500 | 4891 | 16 |
| CO 53 | 6 | 2 | 4688 | 6300 | 5475 | 35 |
| *Jothimattai* | 5 | 2 | 3150 | 4800 | 4200 | - |
| Over all mean grain yield = 5121kg/ha; SEm = 106 | | | | | | |

**Table 2: Economics, technology gap and technology index of improved rice varieties under rainfed conditions**

| Rice variety | Economics of demonstration (Rs./ha) | | | Technology gap and index | | |
|---|---|---|---|---|---|---|
| | Gross Return | Net Return | BCR | Extension Gap (kg/ha) | Technology Gap (kg/ha) | Technology index (%) |
| TKM 13 | 70787 | 39287 | 2.25 | 1555 | 1016 | 15 |
| RNR 15048 | 70414 | 38914 | 2.24 | 1171 | 1779 | 25 |
| ADT 53 | 61931 | 31931 | 2.06 | 835 | 1115 | 18 |
| CO 51 | 60159 | 30159 | 2.01 | 691 | 1609 | 25 |
| CO 53 | 65700 | 35700 | 2.19 | 1275 | 825 | 13 |
| *Jothimattai* | 51660 | 21660 | 1.72 | -- | -- | -- |

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# Profile Characteristics of Agri Input Dealers in Telangana State

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*Agricultural extension helps in transfer of technology, adoption of innovations, increasing efficiency in agriculture production. Public extension service providers included SDA, DAATTC, KVK, ATMA etc. As these are ineffective to reach every corner of the country, private extension service providers entered the scenario. Private extension service providers included-Input agencies, large Agri business firms, farmer organizations and producer cooperatives, NGOs, etc. According to the NSSO data (2005), Agri. Input Dealers (AIDs) are the primary source of farm information to the farmers. Percentage of farmer households accessing farm information through KVKs-0.7%, extension worker-5.7%, Agri. Input Dealers -13.1%. This paper focused to study the profile characteristics of Agri. Input Dealers. Ex-post facto research design was adopted for the study with a sample of 90 respondents covering 3 districts of Telangana. From the analysis, it was found that majority of respondents fall under medium profile characteristics.*

**Keywords**: Profile Characteristics, Agricultural Input Dealers, Agricultural Extension, Telangana

## Introduction

Agricultural development is critical in India because 70 per cent of population relies on agriculture for their livelihood (FAO, 2017-18). Agricultural development encompasses not only crop production but also, development of its stakeholder's viz., farmers, extension workers, Agri. Input Dealers, NGOs etc. Extension and advisory services are an important part of agriculture and rural development, and have been shown to contribute to the reduction of hunger and poverty, enhance the adoption of improved technologies, and increase productivity and capacity of clientele. The public sector is major extension service provider and the reach of public extension is limited in India and in addition it is burdened with non-extension responsibilities such as the distribution of subsidies and inputs, with little time left to focus on core extension activities. Agricultural extension in India is in transition.

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Pluralistic extension system is provision of extension services for a community which is conducted by more than one source of extension services (Okorley, Grey, & Reed, 2010). Saravanan and Shivalinge Gowda (1999) stated that privatization of agricultural extension service (PAES) refers to the services rendered in the area of agriculture and allied aspects by extension personnel working in private agencies or organizations for which farmers are expected to pay a fee and it can be viewed as supplementary or alternative to public extension services.

Agri. Input Dealer is a businessperson involved in the sales and distribution of agricultural inputs to farmers and is a prime source of farm information to the farming community, besides the supply of inputs and credit.

The situation assessment survey of farmers conducted during the 59$^{th}$ round of the National Sample Survey (NSSO, 2005) provided valuable insights into reach of extension services across India. The data collected from 51,770 households in 6638 villages showed that sixty percent of farmer households did not access any information on modern technology that year. For the farmers who accessed information, progressive farmers and the Agri. Input Dealers were the main source of information. NSSO (2005) reported that 80 percent of farmers who obtained information from AIDs or other progressive farmers tried or adopted them. At all India level, the AIDs stood second (13.10%) in access to farming community for providing information on modern agriculture technology, first being the progressive farmers.

DFI Committee (2017) noted that Agri. Input Dealers, who number more than 3,00,000 may be effectively used as 'extension delivery points' by displaying the literature related to schemes and programmes of both central and state governments, new technologies and extension messages including weather and market information. Agricultural inputs and advisory services provide basis for quality production. There is immense possibility of mainstreaming of AIDs as para extension professionals. However, any effort in this direction necessitates empirical data and evidences on the profile of AIDs to design appropriate interventions for the purpose. Realizing this, the present study was taken up to profile the AIDs of Telangana State using an ex-post facto survey research during 2021-22. The main objective of this article is to analyze and present the profile of AIDs in terms of their personal, demographic, socio-economic and psychological characteristics.

## Materials and Methods

Telangana State was chosen for the study. The present study was undertaken in Khammam, Karimnagar, Rangareddy districts (1 district for each zone) covering all the three zones of Telangana State. All these 3 districts were randomly selected from the State of Telangana. Two mandals are selected for each district (total of 6 mandals from 3 districts) purposively based on the highest number of Agri. Input Dealers for investigation. From each mandal 2

villages were selected randomly based on extension and agro advisory services received by the farmers in villages from the Agri. Input Dealers. 90 Agri. Input Dealers (30 from each district) who are in the business continuously for at least 3 years were selected randomly. A total number of 90 farmers (30 from each district, six each from the five Agri. Input Dealers with three years of interaction) were selected randomly.

Data were collected from the respondents by using a pre-tested interview schedule and analysed using Statistical Package for Social Sciences (SPSS 20).

## Results and Discussion

**Table 1. Distribution of AIDs based on their demographic profile characteristics (n=90)**

| S.No. | Characteristics | Frequency | Percent |
|---|---|---|---|
| **1** | **Age (Years)** | | |
| | Young (< 35 years) | 5 | 5.56 |
| | Middle (35-55 years) | 68 | 75.56 |
| | Old (>55) | 17 | 18.88 |
| **2** | **Education** | | |
| | Middle school (5-7) | 1 | 1.11 |
| | High school (8-10) | 4 | 4.44 |
| | PUC (11-12) | 17 | 18.89 |
| | Diploma | 2 | 2.22 |
| | Graduates (Arts/Commerce/Management/science) | 60 | 66.67 |
| | Agricultural graduate | 6 | 6.67 |
| **Mean= 6.24** | | | **S.D=1.49** |
| **3** | **Family profile** | | |
| | Low (below 5.7 score) | 6 | 6.67 |
| | Medium (between 5.7 to 11.5 score) | 73 | 81.11 |
| | High (above 11.5 score) | 11 | 12.22 |
| **Mean= 8.57** | | | **S.D=2.87** |
| **3(a)** | **Family type** | | |
| | Joint | 11 | 12.22 |
| | Nuclear | 79 | 87.78 |
| **3(b)** | **Family size** | | |
| | Small family | 5 | 5.56 |

| S.No. | Characteristics | Frequency | Percent |
|---|---|---|---|
| | Medium family | 74 | 82.22 |
| | Large | 11 | 12.22 |
| **Mean= 5.25** | | | **S.D=1.64** |
| **3(c)** | **Number of dependents** | | |
| | Low (below 1.98 score) | 4 | 4.44 |
| | Medium (between 1.98 to 4.66 score) | 73 | 81.11 |
| | High (above 4.66 score) | 13 | 14.45 |
| **Mean= 3.32** | | | **S.D=1.34** |
| 3(d) | **Primary occupation** | | |
| | Business (AID/Other) | 55 | 61.11 |
| | Service (State/Central/Private) | 0 | 0.00 |
| | Farming | 0 | 0.00 |
| | Business + farming | 32 | 35.56 |
| | Farming+business | 3 | 3.33 |
| | Other | 0 | 0.00 |
| **4** | **Experience as Agri. Input Dealer(s)** | | |
| | Low (below 9.12score) | 15 | 16.67 |
| | Medium (between 9.12 to 22.99 score) | 57 | 63.33 |
| | High (above 22.99 score) | 18 | 20 |
| **Mean=16.05** | | | **S.D=6.93** |

The data in Table 1. revealed that majority of the Agri. Input Dealers (75.56%) belonged to 'middle age' group (35 to 55 years) followed by, 18.88 per cent in the 'old age' group and 5.56 per cent in the 'young age' group. From the above findings it can be concluded that the majority of the Agri. Input Dealers belonged to middle age group. Furthermore, AIDs between the ages of 35 and 55 have more work responsibilities than those under the age of 35. This could be the fundamental reason why the majority of AIDs are under middle age group.

A cursory look at the data pertaining to the actual formal education obtained by the respondents, indicates that two-thirds of the AIDs (66.67%) are graduates followed by PUC (18.89%). Very few of them are having a professional degree in Agriculture (6.67%). Other categories, like middle or high school and diploma educated AIDs, together constituted insignificant percentage of the total (7.77%). None of the respondents reported for No school education (Illiterate), Primary school (1-4), ITI, Any others (Technical course).

The results, thus, necessitate encouraging the AIDs to take up formal education in agriculture in distance or online mode, particularly courses like Diploma in Agri Extension Services for Input Dealers (DAESI) offered by National Institute of Agricultural Extension Management (MANAGE), Hyderabad.

On aggregate analysis, it is observed that majority of AIDs belong to medium family profile category (81.11%), followed by high (12.22%) and low (6.67%) categories. This result is partially similar to the findings of Borah (2019). Family profile was also analyzed in terms of its specific components like family type, family size, number of dependents and family occupation.

Experience-wise distribution of respondent AIDs as presented in Table 4.1 and Figure 4.3, shows that majority of AIDs have to medium level of experience (63.33%) followed by high (20%) and low (16.67%) levels. According to the data, more than half of the AIDs in the study area had enough experience in both supplying inputs and offering farm services. As a result, they provide appropriate advice based on their experience.

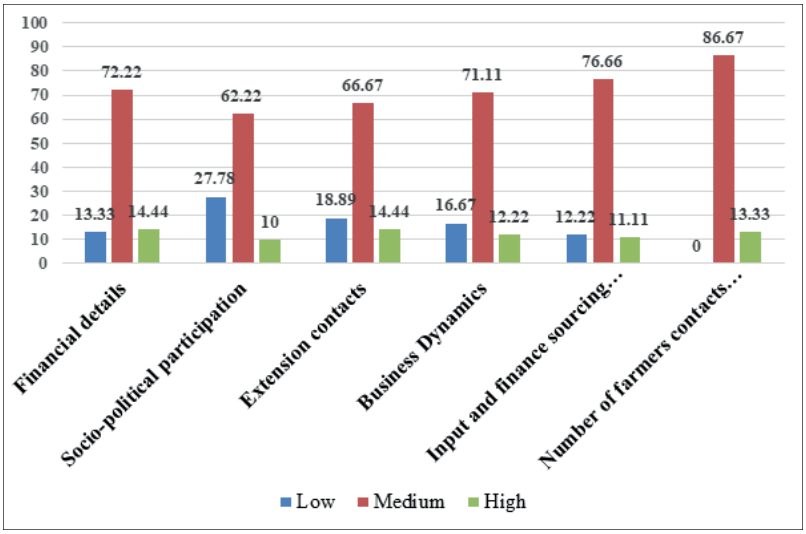


**Figure 1. Distribution of AIDs based on their socio-economic profile characteristics (n=90)**

From the figure 1, it was evident that 72.22 percent AIDs had medium financial profile, followed by high (14.44%) and low (13.33 %). The reason might be due to success in the business and also majority of AIDs fall under medium degree of socio-political participation (62.22%) followed by low (27.78%) and high (10%). The probable reason for the kind of result might be that socio-political participation is considered as prestigious and their interest towards such participation and economic profits they are gaining through such participation.

It can be summarized from table 2 that majority of AIDs (66.67 per cent) had medium extension contact, followed by low extension contact (18.89 per cent) Whereas (14.44 per cent) AIDs had high extension contact and 71.11 percent AIDs fall under medium, followed by 16.67 percent low and 12.22 percent high business dynamics category and 76.66 percent AIDs had medium input and finance sourcing behaviour, followed by 12.22 percent low,11.11 percent high.

The response analysis for the variable number of farmers contacts per Agri. Input Dealers from the table 2 shows that AIDs had 86.67 percent medium level of farmers contacts followed by 13.33 percent in high contact category.

**Table 2. Distribution of AIDs based on their psychological profile characteristics (n=90)**

| S. No. | Reason for the motivation | Yes | | No | |
|---|---|---|---|---|---|
| | | f | % | f | % |
| 1 | Family business by forefathers | 60 | 66.67 | 30 | 33.33 |
| 2 | Self motivation | 67 | 74.44 | 23 | 25.56 |
| 3 | Motivation by elders in the family | 50 | 55.56 | 40 | 44.44 |
| 4 | Business prospects in the area | 75 | 83.33 | 15 | 16.67 |
| 5 | Want to help farmers in the region | 63 | 70.00 | 27 | 30.00 |
| 6 | Motivated by DOA, KVK, Other scientists | 1 | 1.11 | 89 | 98.89 |

**Table 3. Awareness of AIDs on Government programs**

| S. No. | Awareness on government programs | Fully aware | | Partially aware | | Not aware | |
|---|---|---|---|---|---|---|---|
| | | f | % | f | % | f | % |
| 1 | e-NAM | 16 | 17.8 | 15 | 16.7 | 59 | 65.6 |
| 2 | PMFBY | 64 | 71.1 | 5 | 5.6 | 21 | 23.3 |
| 3 | PMKSY | 13 | 14.4 | 7 | 7.8 | 70 | 77.8 |
| 4 | PKVY | 10 | 11.1 | 2 | 2.2 | 78 | 86.7 |
| 5 | PM AASHA | 15 | 16.7 | 10 | 11.1 | 65 | 72.2 |
| 6 | Rythu Bandhu | 87 | 96.7 | 1 | 1.1 | 2 | 2.2 |
| 7 | DHARANI Portal | 85 | 94.4 | 3 | 3.3 | 2 | 2.2 |
| 8 | Any other | 3 | 3.3 | 3 | 3.3 | 84 | 93.3 |

From the table 2 it was evident that majority of AIDs fall under medium level of motivation category (64.44%), followed by low and high (17.78% and 17.78). and from the table it was also evident that the main reason of motivation to start Agri. Input Dealership was due to business prospects in the area followed by self motivation, want to help farmers in

the region, family business by forefathers, motivation by elders in the family, motivated by DOA, KVK, Other scientists. AIDs might have made a bigger net profit as a result of Agri. Input Dealership. As a result, their interest and desire to gain even more from agri input selling would have heightened, as evidenced by the results.

Table 3 indicates that majority of AIDs (83.33 percent) had medium level of awareness about government programs followed by high (14.45 percent) and low (2.22 percent) awareness. The probable reason for the kind of result might be that majority of AIDs know only about state government schemes and programs and few central government schemes like PMFBY.

## Conclusion

The findings of the study revealed that 100% of AIDs were medium in their profile characteristics. Hence the planners and development agencies need to give attention on medium level of profile characteristics of AIDs while planning training programmes and in effective integration of AIDs with public system.

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# Foxtail Millet as an Alternative to Groundnut under Rainfed Conditions

**Sahaja Deva[1], R.Prasanna Lakshmi[2] and MK Jyosthna[3]**

## ABSTRACT

*Demonstrations were conducted at farmers fields at Guttapalem (Kalikiri mandal) and Murevandlapalli (Vayalpadu mandal) of Andra Pradesh during Kharif 2020-21 and 2021-22 in 4.0 ha area during each year to study the performance of improved variety of Foxtail millet (SiA 3156) as an alternative to traditional crop groundnut under rainfed conditions. Under demonstrations treatment comprised of Foxtail millet variety SiA 3156 which matures in 85-90 days with an average yield potential of 20-25 q/ha and compared with groundnut variety Kadiri 6. Foxtail millet performed well under rainfed situations where crop failure of groundnut was occurred. Pooled data of two years proved that Net returns and B: C ratio of foxtail millet were significantly higher than Groundnut variety Kadiri 6. Foxtail millet var SiA 3156 recorded 15750 Rs./ha net returns and B:C ratio of 2.1. Whereas, Groundnut var Kadiri 6 recorded net returns and B: C ratio of 1150 Rs./ ha and 1.0, respectively.*

**Keywords:** Foxtail Millet, Groundnut, Yield, Millets, Rainfed Agriculture, Andhra Pradesh

## Introduction

Groundnut is one of the major oilseed crops of India accounting for 25% of total oilseed production in the country. It occupies an area of 5.30 million ha with a production of 5.50 million tonnes and productivity of 1040 kg/ha (http://www.indiastat.com). In Andhra Pradesh, groundnut was grown in an area of 7.48 lakh ha with production of 4.62 lakh tonnes production and productivity of 618 kg/ha (http://www.indiastat.com). In Chittoor district groundnut is one of the major Oilseeds crops. It ranks first in area and production of Oilseeds. The crop is cultivated in 123268 ha during *Kharif*, 2020-21 and 2124 ha during *Rabi*, 2020-21 in Chittoor district (O/o JDA, Chittoor). Groundnut is cultivated in diverse agro-climatic environments characterized by soils of varying water holding capacity under rainfed as well as irrigated conditions (Priya *et al*, 2016). In western

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mandals of Chittoor district, 85% area of groundnut is under rainfed condtions. Under water stress conditions huge losses are occurring due to very low yields in groundnut. Sometimes, crop failure may also occur during extreme water stress conditions. To mitigate the problems, an improved variety of Foxtail millet SiA 3156 was introduced in western mandals of Chittoor district. Foxtail millet can grow even with 300-350 mm rainfall and can also tolerate water stress conditions and gives better yields. When there is groundnut crop failure, foxtail millet can provide income to farmers. Foxtial millet can be grown as sole crop or as inter crop with groundnut. The KVK, Kalikiri demonstrated the performance of foxtail millet variety SiA 3156 during 2019-20 and 2020-21 under rainfed conditions.

## Materials and Methods

Front Line Demonstrations on Foxtail millet variety SiA 3156 were conducted in red sandy loam soils in western mandals of Chittoor district during *Kharif* season in farmers fields at Guttapalem (Kalikiri M) during 2020-21 and Murevandlapalli (Vayalpadu M) during 2021-22 in an area of 4.0 ha with 10 farmers during each year. An improved variety of Foxtail millet var SiA 3156 (T1) was compared with groundnut var Kadiri 6 (T2), a local variety grown by farmers in terms of yield attributes and yield. Farmers have applied 20 q FYM/acre, urea @ 25 kg/ac, SSP @ 100 kg/ac and MOP @ 35 kg/ac. For foxtail millet no management practices were followed.

Five plants were selected in each field and data was recorded on plant height, Number of pods/plant, 100 pod and seed weight for Groundnut and Plant height, Number of productive tillers/plant, Panicle length, Panicle weight and Test weight for Foxtail millet. Yield of Foxtail millet and Groundnut were recorded from 10 farmers fields during each year in an area of 0.4 ha per farmer. Data recorded was statistically analyzed.

Economics was calculated as shown below:

**Cost of cultivation (₹ $ha^{-1}$)**

Cost of cultivation (₹ $ha^{-1}$) was calculated considering the prevailing charges of agricultural operations and market price of inputs involved.

**Gross returns (₹ $ha^{-1}$)**

Gross returns were obtained by converting the harvest into monetary terms at the prevailing market rate during the course of studies.

Gross return (₹ $ha^{-1}$) = (Seed yield x price)

**Net returns (₹ $ha^{-1}$)**

Net returns were obtained by deducting cost of cultivation from gross return.

Net returns (₹ $ha^{-1}$) = Gross return (₹ $ha^{-1}$) - Cost of cultivation (₹ $ha^{-1}$)

**Cost: Benefit ratio**

The benefit: cost ratio was calculated by dividing gross returns by cost of cultivation.

$$\text{Cost: benefit ratio} = \frac{\text{Gross returns (₹ ha}^{-1})}{\text{cost of cultivation (₹ ha}^{-1})}$$

**Table 1: Technological options**

| Technology Options | Crop | variety | Source of technology |
|---|---|---|---|
| T1 | Groundnut | Kadiri 6 | ARS, Kadiri |
| T2 | Foxtail millet | SiA 3156 | RARS, nandyal |

**Table 2: Salient features of Groundnt var Kadiri 6 and Foxtail millet var SiA 3156**

| Variety | Duration | Pod yield (q/ac) | | Shelling % | 100 seed weight (g) | SMK % | Oil content (%) | Special features |
|---|---|---|---|---|---|---|---|---|
| | | *Kharif* | *Rabi* | | | | | |
| Groundnut var Kadiri 6 | 100-105 | 8-8.8 | 16-17 | 72 | 40-45 | 89 | 48 | Popular among farmers for its quality attributes |
| Foxtail millet var SiA 3156 | 85-90 | 8-10 | | - | - | - | - | Highly responsive to nitrogenous fertilizers |

**Advantages of Foxtail millet var SiA 3156 over Groundnut var Kadiri 6**

Foxtail millet can perform well even under water stress conditions whereas groundnut crop failure takes place. During severe drought farmers are getting negative net returns where foxtail millet can give net profit to farmers with less cost of cultivation.

## Results and Discussion

**Table 3: Yield attributes of Groundnut var Kadiri 6 and Foxtail millet var SiA 3156**

| Particulars | Groundnut var Kadiri 6 | | | Foxtail millet var SiA 3156 | | |
|---|---|---|---|---|---|---|
| | 2020-21 | 2021-22 | Mean | 2020-21 | 2021-22 | Mean |
| Plant height (cm) | 38.6 | 42 | 40.3 | 115 | 111 | 113 |
| No. of filled pods/plant | 18.0 | 24 | 21 | - | - | - |
| No. of productive tillers/ plant | - | - | - | 4.0 | 5.0 | 4.5 |
| Panicle length (cm) | - | - | - | 19.6 | 21.2 | 20.4 |

| Particulars | Groundnut var Kadiri 6 | | | Foxtail millet var SiA 3156 | | |
|---|---|---|---|---|---|---|
| | 2020-21 | 2021-22 | Mean | 2020-21 | 2021-22 | Mean |
| Panicle weight (g) | - | - | - | 6.6 | 8.2 | 7.4 |
| Test weight (g) | - | - | - | 3.0 | 3.0 | 3.0 |
| Fresh 100 pod weight (g) | 112 | 145 | 128.5 | - | - | - |
| Fresh 100 seed weight (g) | 32 | 50 | 41 | - | - | - |
| Dry 100 pod weight (g) | 69 | 94.2 | 81.6 | - | - | - |
| Dry 100 seed weight (g) | 21.7 | 38.7 | 30.2 | - | - | - |

**Yield attributes:** On an average no. of filled pods/plant in Kadiri 6 are 21.0. Fresh and dry 100 pod weight were 128.5 g and 81.6 g, respectively; fresh and dry 100 seed weight were 41 and 30.2 g, respectively. Whereas, number of productive tillers/plant in foxtail millet var SiA 3156 were 4.5. Panicle weight is 7.4 g and test weight is 3.0 g (Table 3). Panicle weight of SiA 3156 was higher in Foxtail millet var SiA 3156 (Sahaja *et al*., 2019).

**Table 4: Yield and economics of Groundnut var Kadiri 6 and Foxtail millet var SiA 3156**

| Year | Yield (q $ha^{-1}$) | | Gross returns (Rs $ha^{-1}$) | | Net returns (Rs $ha^{-1}$) | | B: C ratio | |
|---|---|---|---|---|---|---|---|---|
| | Groundnut var Kadiri 6 | Foxtail millet var SiA 3156 | Groundnut var Kadiri 6 | Foxtail millet var SiA 3156 | Groundnut var Kadiri 6 | Foxtail millet var SiA 3156 | Groundnut var Kadiri 6 | Foxtail millet var SiA 3156 |
| 2020-21 | 8.1 | 4.4 | 44550 | 22000 | -5450 | 7000 | 0.89 | 1.5 |
| 2021-22 | 10.5 | 7.9 | 57750 | 39500 | 7750 | 24500 | 1.2 | 2.6 |
| **Mean** | 9.3 | 6.2 | 51150 | 30750 | 1150 | 15750 | 1.0 | 2.1 |

*Low yields during 2020-21 were due to heavy rains at the time of crop growth and harvesting

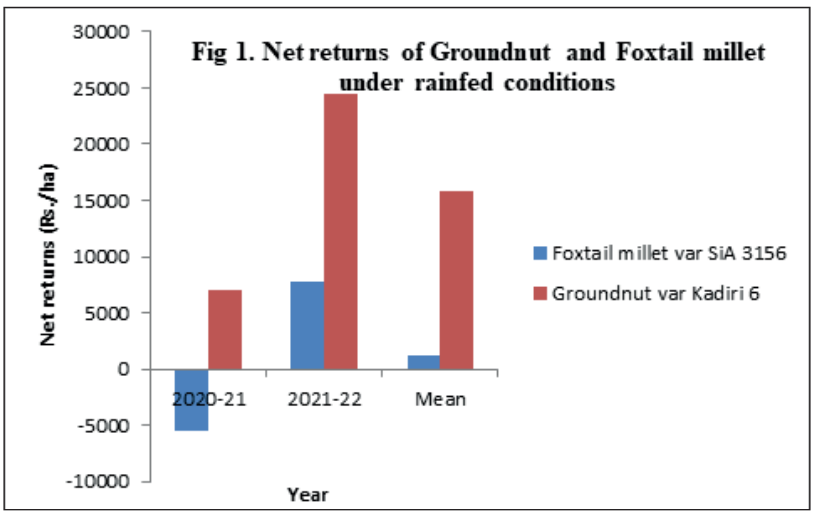
**Table 5: Summary of t-test in comparing net returns and B: C ratio in treatment and farmers practice for two years pooled mean**

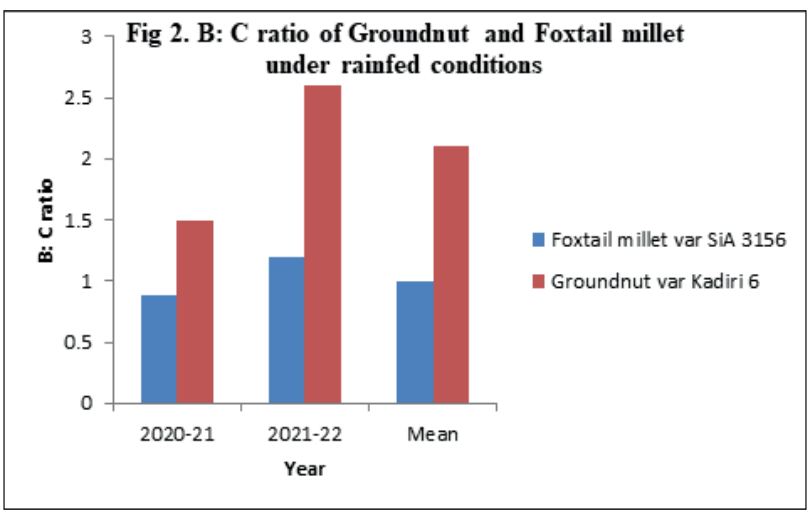
| Year | Treatments | N | Mean | Std.Deviation | t-value | p-value |
|---|---|---|---|---|---|---|
| Net returns | Foxtail millet var SiA 3156 | 10 | 15750 | 22.4 | 2.57* | 0.004** |
| | Groundnut var Kadiri 6 | 10 | 1150 | 9.62 | 2.57* | 0.004** |
| B: C ratio | Foxtail millet var SiA 3156 | 10 | 2.1 | 0.11 | 2.36* | 0.003** |
| | Groundnut var Kadiri 6 | 10 | 1.0 | 0.16 | 2.36* | 0.003** |

*Significant at 5% level **Significant at 1% level

## Yield and Economics

Perusal of the data presented in the table 4, fig.1 & 2 revealed that average yield of Foxtail millet was 6.2 q/ha and groundnut is 9.3 q/ha. Mean gross returns of Groundnut were 51150 Rs $ha^{-1}$. And Foxtail millet was 30750 Rs $ha^{-1}$. Mean net returns of Grounndut and Foxtail millet were 1150 and 15750 Rs $ha^{-1}$, respectively. Mean B: C ratio of Foxtail millet and groundnut were 2.1 and 1.0, respectively. Eventhough, yield and gross returns of foxtail millet were lower than groundnut net returns and B: C ratio were higher as the cost of cultivation is very less for Foxtail millet compared to groundnut and statistically significant difference was observed in net retuns and B: C ratio of Foxtail millet and groundnut (Table 5).



## Conclusion

Foxtail millet var SiA 3156 performed well during Kharif under rainfed conditions compared to groundnut local variety. Due to crop failure, negative returns were obtained in groundnut due to its high cost of cultivation but farmers who have grown Foxtail millet got net profit as the cost of cultivation is very low. Net returns and B: C ratio were significantly higher in Foxtail millet. So it has been concluded that Foxtail millet is the best alternative for rainfed groundnut.

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