UNIVERSITY OF AGRICULTURAL SCINCES DHARWAD

DEPARTMENT OF AGRICULTURE

GOVT. OF KATRNTAKA, BENGALURU

Research highlights of
Operational research Project on
NATURAL FARMING, Zone 8 (Agriculture)
(2018-2019, 2019-2020 and 2020-2021)

Submitted by
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Operational Research Project on Natural Farming (ZBNF)

The Zero Budget Natural Farming(ZBNF) is renamed as Natural farming project is a holistic agriculture method that seeks to eliminate the need for purchase of outside materials, such as pesticides and fertilizers, in order to yield healthy crops.The four pillars of ZBNF are Beejamrutha, Jeevamrutha, Acchadana (Mulching) and Whapasa (Aeriation). Department of Agriculture, Government of Karnataka in collaboration with State Agricultural Universities (SAU'S) and farmers has come out with a mega Operational Research Project and Demonstration programme covering all ten agro-climatic zones of the state. The proposed project intends to undertake strategic, process and applied multi-disciplinaryresearch with an objective to develop sustainable Natural Farming systems in different crops in Kharif (13 trails), rabi (6 trails on sorghum, wheat, chickpea and chickpea based cropping system) and 3 crops in summer for comparative evaluation of Natural Farming (ZBNF) with other farming practices. To aassess the soil health dimensions (physical, chemical and biological) and capacity building programmes to the farmers to promote the natural farming in comparison with other production systems.

1. The yield levels on par with RPP and net returns were hihger than RPP in summer green gram, black gram and ground nut due to reduced input costs
2. In kharif soybean and cotton + G. nut and ground nut based millet (Foxtail, brown top, kodo millet and barn yard millet) intercropping system were neutral with higher net returns even with 10 – 15 % yield reduction
3. Yield reduction was major In maize (50-60%), sugarcane (40-50%), wheat (40%) and sorghum (30%) to the extent of 30 to 60% due to their higher nutrient demand and short supply under natural farming
4. Microbial populations wrt general and beneficial micro flora were higher with organic and natural farming practices than RPP and chemical farming.
5. The organic carbon content generally increased in OF and NF, moderate in RPP and least in chemical farming
6. The Earth worm populations were enormously increased in Natural farming to the extent to 3 to 5 lakhs followed by OF and least in RPP and CF
7. Generally the major available nutrients reduced in NF in all the cropping systems due to nutrient mining as compared to RPP.

8. General and beneficial micro flora were higher in jeevamurtha ghana jeevamrutha of deshi cow dung than cross bred and buffaloes

OPERATIONAL RESEARCH PROJECT ON NATURAL FARMING		
1	Title of the scheme/project	**Comparative Evaluation of Natural Farming Systems for Enhancing the Livelihood of Farm Families in Zone 8**
2	a) Name and address of the institute	University of Agricultural Sciences, Dharwad
	b) Name and address of the head of the institute	Dr. M.B.Chetti Vice-Chancellor University of Agricultural Sciences, Dharwad Tel : 0836 – 2447783 Fax : 0836 – 2448349 E mail : vc_uasd@rediffmail.com, vc@uasd.in
	c) Name and address of the executive authority of the institute	Dr. P.L. Patil Director of Research UAS, Dharwad-580 005 Tel.:0836-2745903/2214240, Fax No.: 0836-2748377 Email: dr@uasd.in, druasd@rediffmail.com
4	Location	Zone 8- Northern Transition zone of Karnataka
	Actual location where the Research work will be carried (ORP sites)	Main Regional Research Station, Dharwad ARS, Hukkeri, UAS, Dharwad College of Agriculture, Hanumanamatti, UAS, Dharwad Selected Farmer's fields for Farmers Participatory Research on important crops of the zone
	ORP demonstration sites	Ten farmers for each crop across the zone. Selected crops are Cereals: Maize, Sorghum, wheat, Millets: Little millet, Foxtail millets, Finger millet, Barn yard millet, Kodo millet Pulses: Green gram, Red gram, Black gram, chickpea Oilseeds: Soybean, linseed and Groundnut Commercial crops: Cotton and sugarcane
5.	**Information regarding ORP team**	
	i. Nodal officer	Dr. M. N. Sreenivasa Professor of Agronomy and Head Institute of Organic farming UAS, Dharwad, -580005
	ii. ORP Professor and Principal Investigator	Dr. C.P. CHANDRASHEKARA Professor of Agronomy College of Agriculture, Dharwad, -580005 E mail ID: cpcshekar@gmail.com, chandrashekharcp@uasd.in Mobile No: 7829165693
	iii. ORP Scientists	**Agronomist:** 1. Dr. Chidanand P. Mansur, COA Hanumanamatti

		2. Dr. S.A. Gaddanakeri, *IOF, UASD* 3. Dr. B. S. Yenagi, *AICRP on Groundnut, MARS, Dharwad* 4. Dr. S. S. Nooli, ARS, Hukkeri
		Entomologist: 1. Dr. Shekharappa, *IOF, UASD* 2. Dr. Channakeshava, *Jr. Entomologist, AICRP on Soybean, MARSD*
		Plant Pathologist: 1. Dr. Shripad Kulkarni, *Professor of Pl. Pathology & Head, AC, Dharwad* 2. Dr. Ballol Gurupad, *Asst. Professor, AICRP on MULLaRP, MARSD*
		Economist/Agribusiness: Dr. R.A. Yeledhalli, *Professor of Agril. Marketing, AC, Dharwad*
		Horticulture: Dr. M.S. Biradar , *Asst. Professor of Horticulture, Seed Unit, Dharwad*
		Breeder: Dr. N.G. Hanamaratti, *Principal Scientist (sorghum), AICRP ON SORGHUM, MARS, Dharwad*
		Microbiologist: 1. Dr. C. R. Patil, *IOF, UASD* 2. Dr. Mrs. Goudar Geeta, *Jr. Microbiologist, AICRP on Bio-gas, MARSD*
		Soil Scientist: 1. Dr. Manjunath Hebbar, *IOF, UASD* 2. Dr. S. T. Hundekar, *Soil Physicist, AICRP on Agroforestry, MARSD*
	iv. Other ORP team members	1. Dr. I. S. Katageri, Associate Director of research (HQ) of the Zone UAS, Dharwad
		2. Joint Directors of Agriculture, Dharwad, Haveri, Belagavi and Gadag
		3. Deputy Director Horticulture, Dharwad and Belagavi
		4. Deputy Director of Animal Husbandry, Dharwad
		5. NATURAL FARMING farmer one each from Dharwad, Haveri, Belagavi, and Gadag districts
	V. Research Team	1. Dr. Manjunatha S. B. *Research Associate (Agronomy)*
		2. Dr. Bheemanagouda O Patil, *Research Associate (Agril. Economics)*
		3. Dr. Girish V. P. *Research Associate (Agril. Entomology)*
		4. Dr. Sankalpa C. P. *Research Associate (Soil Science)*
		5. Dr. Nagaraj Takkunavr *Research Associate (Plant Pathology)*
		6. Mr. Shivanand Goudar, *Senior Research fellow (Agronomy)*
	Vi. Office Staff	1. Mr. Shabbir Bukkatigar, *Office Assistant*
		2. Manjunatha S. Patil, *Field Assistant*

List of the Natural Farming Experiments

S I No.	Title of the experiment	Year Of start	No. of years conducted
MARS, Dharwad			
1.	Validation of different farming practices in Green gram- rabi Sorghum cropping system	2019-20	Three
2.	Validation of different farming practices in maize-chick pea cropping system	2019-20	Three
3.	Validation of different farming practices in Soybean-wheat cropping system	2019-20	Three
4.	Validation of different farming practices in soybean + maize - Chickpea + linseed cropping system	2019-20	Three
5.	Validation of different farming practices in Cotton+ ground nut- Green gram system	2019-20	Three
6.	Validation of different farming practices in Cotton+ ground nut- Black gram system	2019-20	Three
7.	Validation of different farming practices in Maize + Redgram-cropping system	2019-20	Three
8.	Validation of different farming practices in Soybean + Red gram- Ground nut cropping system	2018-19	Three
9	Validation of different farming practices in Black gram-wheat cropping system	2019-20	Three
10	Validation of different farming practices in different cropping systems in NPOF established organic plot Cotton + Ground nut, Maize – Chick pea Green gram – Sorghum, Soybean – wheat Cotton + Chilli+ onion	2019-20	Three
11	Validation of different farming system in Red gram based inter cropping system (Soybean, Black gram and ground nut)	2019-20	Three
12	Nutrient management in wheat through Jeevamrutha and Cow urine under natural farming in irrigated condition.	2020-21	One
14	Analysis of microbial population nutrient content and enzymatic activities in different desi/cross bred cow/ bullocks and buffaloes	2021-22	One
College of Agriculture, Hanumanamatti			
15	Validation of different farming system in ground nut based millet intercropping system	2019-20	Three
16	Validation of different farming system in Red gram based millet inter cropping system	2019-20	Three
ARS, Hukeeri			
17	Validation of different farming system in sugarcane based cropping system (seasonal planting)	2018-19	Two

AGRICULTURAL ECONOMICS

RESEARCH HIGHLIGHTS OF THE "NATURAL FARMING PROJECT" AT UAS, DHARWAD OF KARNATAKA (ZONE -08 (AGRI))

RABI SEASON AT MARS, DHARWAD (2018-19)

1. Validation of different farming practices in Bengal gram during Rabi season at MARS, Dharwad (2018-19)

- Chickpea grain yield was higher under RPP (19.15 q ha^{-1}) than NF (13.74 q ha^{-1}) and OF (12.07 q ha^{-1}). About 28 per cent lesser yield was obtained under NF than RPP and 14 per cent higher than OF.
- Among the three cultivation practices, the least cost was under NF (Rs. 43,338 ha^{-1}) than RPP (Rs. 46,279 ha^{-1}) and OF (Rs. 50,165 ha^{-1}). Material cost was estimated to be Rs. 10,513 per hectare (about 18 per cent lesser than RPP) under NF than RPP (Rs. 12,858 ha^{-1}) and OF (Rs. 16,755 ha^{-1}) among the three practices.
- Least cost of production was incurred under RPP (Rs. 2,417 q^{-1}) than NF (Rs. 3,154 q^{-1}) and OF (Rs. 4,156 q^{-1})
- Without premium price, the positive and high net returns of Rs. 53,453 ha^{-1} and Rs. 29,766 ha^{-1} were obtained under RPP and NF, respectively, whereas, net returns obtained under OF was only Rs. 13,296 ha^{-1}.
- With premium price for NF and OF produce the net returns obtained was higher under RPP (Rs. 55,453 ha^{-1}) than NF (Rs. 43,533 ha^{-1}) and least was obtained under OF (Rs. 25,391 ha^{-1}). About 9 per cent lesser net return was obtained under NF than RPP.
- The benefit cost ratio of Bengal gram with premium price was higher under RPP (2.16) than NF (2.00) and least in OF (1.51).

2. Validation of different farming practices in wheat during Rabi season at MARS, Dharwad (2018-19)

- The yield of wheat was higher under RPP (32.54qha^{-1}) thanNF (29.58 q ha^{-1}) and OF (26.48qha^{-1}). About 9 per cent yield was reduced under NF than RPP. About 12 per cent higher yield was obtained under NF over OF.
- The cost of cultivation was lower under NF (Rs. 59,518 ha^{-1}, which was about 24 per cent lower than RPP and about 42 per cent lower than OF) and higher was under OF (Rs. 1,01,945 ha^{-1}). About 48 per cent lesser material cost was incurred under NF over RPP. Least production cost was incurred under NF (Rs. 2,012 q^{-1}, which was about 17 per cent lower than RPP) and higher was under OF (Rs. 3,850 q-1).

- Without premium price, the positive net returns of Rs. 30,587 ha-1 and Rs. 21,812ha-1 were obtained under NF and RPP, respectively, whereas, negative net returns were obtained under OF (Rs. -20,841 ha-1). About 40 per cent higher return was obtained under NF over RPP.

- With premium price, the net returns obtained were higher under NF (Rs. 47,744 ha-1) and which was negative under OF (Rs. -5,482 ha-1). This was about 119 per cent higher than RPP. About 41 per cent higher benefit cost ratio was obtained under NF over RPP.

SUMMER SEASON AT MARS, DHARWAD (2019-20)

1. Validation of different farming practices on Green gram during summer at MARS, Dharwad (2019-20)

- The yield was higher under OF (11.79qha-1) than NF (10.75qha-1) and lowest under RPP (8.03qha-1). About 34 per cent higher yield was obtained under NF than RPP.

- Least cost of cultivation of green gram was incurred under NF (Rs. 43,722 ha-1, which was about 19 per cent lower than RPP) and higher was under RPP (Rs. 54,258 ha-1). About 44 per cent material costs were saved under NF over RPP.

- Without premium price, the higher net return was obtained under NF (Rs. 44,537 ha-1) than OF (Rs. 42,706 ha-1) and least was under RPP (Rs. 12,119 ha-1). More than doubled net return was obtained under NF over RPP.

- With the premium price, the net returns obtained was higher under OF (Rs. 61,522 ha-1) than OF (Rs. 61,334 ha-1) and RPP (Rs. 12,119 ha-1). The benefit cot ratio was estimated to be higher under NF (2.41, which was about 97 per cent higher than RPP) than OF (2.14) and RPP (1.22).

2. Validation of different farming practices in Black gram during summer at MARS, Dharwad (2019-20)

- Comparatively higher yield was obtained under RPP (7.93qha-1) than NF (7.43qha-1) and OF (6.71qha-1). About six per cent lower yield was obtained under NF over RPP.

- The cost of cultivation incurred was higher under RPP (Rs. 53,417 ha-1) and least under NF (Rs. 42,625 ha-1). About 20 per cent total costs were saved under NF than RPP. The large amount was saved in material cost under NF (44 per cent) when compared to RPP.

- Without premium price, the net returns was higher under NF practice (Rs. 12,715 ha-1) and negative was under OF (Rs. -2,241 ha-1). About 156 per cent higher net return was obtained under NF over RPP.

- With premium price, the net return was estimated to be higher under NF (Rs. 23,117 ha-1) than OF (Rs. 7,153 ha-1) and RPP (Rs. 4,973 ha-1). About 41 per cent higher benefit cost ratio was obtained under NF (1.54) over RPP (1.09).

3. Validation of different farming practices in ground nut during summer at MARS, Dharwad (2019-20)

- The higher groundnut yield was recorded under RPP (24.75qha-1) as compared to OF (19.03qha-1) and NF (16.66qha-1) practices. About 33 per cent yield was reduced under NF compared to RPP and 12 per cent lower than OF.
- The cost of cultivation worked out to be Rs. 55,020 per hectare under NF practice which was lower than organic and RPP. Natural Farming has resulted in reduction in the cost of cultivation of groundnut by 19 per cent than RPP.
- The production cost of groundnut was highest in case of OF (Rs. 3,920 q-1) than NF (Rs. 3,303 q-1) and least was under RPP (Rs. 2,740 q-1).
- The net return without premium price realized was higher in RPP (Rs. 99,799 ha-1) than NF (Rs. 55,974 ha-1) and least in OF (Rs. 51,874 ha-1). About 42 per cent lesser net return was obtained under NF than RPP.
- With premium price, the net returns obtained were higher under RPP (Rs. 99,799 ha-1) than NF (Rs. 77,632 ha-1) and OF (Rs. 76,613 ha-1). The benefit cost ratio was estimated to be higher under RPP (2.43) than RPP (2.41) and OF (2.03).

KHARIF SEASON AT MARS, DHARWAD (2019-20)

1. Validation of different farming practices in green gram during *Kharif* season at MARS, Dharwad (2019-20)

- The yield of green gram was 7.60qha-1 under NF as against 9.11qha-1 and 8.84qha-1 under RPP and OF, respectively. About 17 per cent lesser yield was obtained in NF than RPP and about 14 per cent lesser than OF.
- The cost of cultivation of green gram was lower under NF (Rs. 34,992 ha-1) when compared to RPP (Rs. 46,122 ha-1) and OF (Rs. 47,482 ha-1). It showed about 24 per

cent lower cost under NF over RPP. About 45 per cent and 12 per cent input and labour costs were saved under NF compared to RPP.

- Per quintal cost of production of green gram was lesser under NF than RPP and OF.
- Without premium price, the net returns obtained under RPP (Rs. 24,003 ha-1) were higher than NF (Rs. 23,308 ha-1) and OF (Rs. 20,418 ha-1). About 10 per cent higher benefit cost ratio was obtained under NF over RPP.
- With premium price, the net return obtained was higher under NF (Rs. 34,708 ha-1, about 31 per cent higher than RPP) than OF (Rs. 33,678 ha-1) and RPP (Rs. 24,003 ha-1). The benefit cost ratio was found to be higher under NF (1.99, which was about 31per cent higher than RPP) than OF (1.71) and RPP (1.52).

2. Validation of different farming practices in black gram during *Kharif* season at MARS, Dharwad (2019-20)

- The results found that the higher yield was obtained under RPP (5.46qha-1) than OF (4.50qha-1) and NF (3.89qha-1, which was about 29per cent lower than RPP and 14 per cent lower than OF).
- Among the three cultivation practices, the minimum cost of cultivation was incurred in NF (Rs. 32,600 ha-1, which was about 25 per cent lesser than RPP) and higher was under OF (Rs. 45,044 ha-1). Labour cost was more or less same under three methods of farming but large amount of money was saved under NF (about 45per cent lower than RPP).
- Without premium price, the positive net returns were obtained under RPP (Rs. 3,482 ha-1) and NF (Rs. 992 ha-1), whereas negative returns was obtained under OF (Rs. -6,209 ha-1).
- With premium price, the higher net return obtained under NF (Rs. 7,551 ha-1, which was 116per cent higher than RPP) and least was under OF (Rs. 1,378 ha-1). About 14 per cent higher benefit cost ratio was obtained under NF (1.23) over RPP (1.08).

3. Validation of different farming practices in Soybean during *Kharif* season at MARS, Dharwad (2019-20)

- Recommended package of practices (RPP) recorded significantly higher grain yield (17.48 kg ha-1) over RPP (17.48qha-1) and OF (15.62qha-1) and NF (14.38qha-1). About 18 per cent lower yield was obtained under NF over RPP.
- The cost of cultivation was higher under OF (Rs. 61,439 ha-1) than RPP (Rs. 58,190 ha-1) and least under NF (Rs. 40,134, which was about 31per cent lesser than RPP). About 59 and 8 per cent material and labour costs respectively were saved compared to RPP. About 16 per cent production cost was saved under NF than RPP.

- Without premium price, net return was higher under NF (Rs. 20,286 ha-1, which was about 35per cent higher than RPP) and least was under OF (Rs. 4,141 ha-1). About 20 per cent higher benefit cost ratio was obtained under NF over RPP.

- With premium price, higher net returns obtained under NF (Rs. 31,790 ha-1, which was about 112 per cent higher than RPP) than RPP (Rs. 16,637 ha-1) and which was negative under OF (Rs. 15,030 ha-1). About 42 per cent higher benefit cost ratio was obtained under NF over RPP.

4. Validation of different farming practices in maize during *Kharif* season at MARS, Dharwad (2019-20)

- Recommended package of practices (RPP) recorded significantly higher grain yield (33.99qha^{-1}) over OF (17.37qha^{-1}) and NF (10.47qha^{-1}) farming systems. About 69 per cent lesser yield was obtained under NF than RPP.

- Cost of cultivation was higher under OF (Rs. 78,763 ha-1) and least was under NF (Rs. 36,373 ha-1, which was about 40 per cent lesser than RPP and about 54 per cent lesser than OF). About 62 per cent material costs and about 20 per cent labour cost were saved under NF compared to RPP.

- Without premium price, the NF and OF practices noticed negative net returns (Rs. -14,854 and Rs. -44,034 ha-1, respectively) as compared to RPP (Rs. 7,521 ha-1).

- Similar trend was seen with premium price, due to drastic reduction in the yield under NF and OF practices. A net return remained negative in case of both NF and OF practices but was positive under RPP.

5. Validation of different farming practices in maize and soybean intercropping system during *Kharif* season at MARS, Dharwad

- The higher yield of maize and soybean were obtained under RPP (26.07 and 13.96qha-1, respectively) than OF (9.17 and 12.29qha-1, respectively) and least was under NF (5.28 and 11.45qha-1, respectively).

- About 80 per cent and 18 per cent lesser yield of maize and soybean respectively was obtained under NF than RPP. About 42 per cent and 7 per cent lesser yield of maize and soybean respectively was obtained under NF than OF.

- Among the three cultivation practices, the less cost of cultivation was incurred in NF (Rs. 43,625 ha-1, which was about 36 per cent lesser than RPP) and higher cost was incurred under OF (Rs. 73,081 ha-1). About 16 per cent of labour cost and 62 per cent of material costs were saved under NF compared to RPP.

- Without premium price, the positive net returns were obtained under RPP (Rs. 40,077 ha-1) and NF (Rs. 15,111 ha-1), whereas negative returns was obtained under OF (Rs-2,472 ha-1).

- With the premium price, the net return was higher under RPP (Rs. 40,077 ha-1) than NF (Rs. 21,486 ha-1) and least was under OF (Rs. 5,562 ha-1).

6. Validation of different farming practices in Red gram + Soybean intercropping system during *Kharif* season at MARS, UAS, Dharwad

- The higher yield of red gram and soybean was obtained under RPP (12.68 and 15.60qha-1, respectively) than OF (11.54 and 10.91qha-1, respectively) and least was in NF (11.64 and 7.70qha-1, respectively). The yield reduction in NF was about 8 and 51 per cent in red gram and soybean respectively than RPP.

- Less cost of cultivation was incurred under NF (Rs. 45,673 ha-1, which was about 36 per cent lesser than RPP and about 48 per cent lesser than OF) than RPP (Rs. 71,595 ha-1) and OF (Rs.87,686 ha-1). The huge amount of material cost was saved under NF (55 per cent) than RPP.

- Without premium prices, higher net returns were obtained under RPP (Rs. 50,969ha^{-1}, about 15 per cent higher than NF) than NF (Rs. 43,239 ha-1) and was least in OF (Rs. 12,689 ha-1). The benefit cost ratio was higher in NF (1.95) than RPP (1.71) and OF (1.14).

- With premium price, the higher net returns was obtained under NF (Rs. 59,859 ha^{-1}) than RPP (Rs. 50,969 ha-1) but comparatively lower return was under OF (Rs. 31,433 ha-1).

KHARIF SEASON AT COLLEGE OF AGRICULTURE, HANUMANAMATTI (2019-20)

1. Validation of different farming practices in ground + finger millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- Recommended package of practices (RPP) registered higher yield (13.89qha^{-1} and 6.10qha^{-1}) over OF (12.39qha^{-1} and 5.93qha^{-1}, respectively), NF (11.46 q^{-1} and 5.91qha^{-1},

respectively) and chemical farming (CF) (11.02qha^{-1} and 4.94qha^{-1}, respectively). About 17 per cent and 3 per cent lesser yield of ground nut and finger millet respectively were obtained under NF than RPP but about 4 per cent and 20 per cent higher yield of ground nut and finger millet respectively were obtained under NF than CF.

- The less cost of cultivation was incurred under NF (Rs. 42,184 ha^{-1}) than NF (Rs. 42,609 ha^{-1}), RPP (Rs. 56,687 ha^{-1}) and OF (Rs. 59,808 ha^{-1}). Labour and material costs were lower under NF and CF system. About 35 per cent input costs were saved under NF over RPP.

- Without premium price, the net returns were estimated to be higher under NF (Rs. 43,597 ha^{-1}, which was about 2 per cent higher than RPP and about 42 per cent higher than OF) and least was obtained under OF (Rs. 30,684 ha^{-1}).

- With premium prices for OF and NF produces, natural farming registered higher net returns of Rs. 60,017 per hectare (which was about 41 per cent higher than RPP and about 26 per cent higher than OF) and least was under CF (Rs. 36,648 ha^{-1}). About 38 per cent higher benefit cost ratio over RPP and about 35 per cent over OF was obtained under NF.

2. Validation of different farming practices in ground + brown top millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- The higher yield of groundnut and brown top millet were obtained under RPP (13.64 and 5.66qha^{-1}, respectively) than OF (13.12 and 4.35qha^{-1}, respectively), NF (11.83 and 4.93qha^{-1}, respectively) and least was under CF (10.97qha^{-1} and 3.65qha^{-1}, respectively).

- About 13 per cent and 13 per cent lesser yield of ground nut and brown top millet respectively were obtained under NF than RPP but about 8 per cent and 35 per cent higher yield of ground nut and brown top millet respectively were obtained under NF than CF.

- The cost of cultivation was estimated to be higher under RPP (Rs. 59,493 ha^{-1}) than OF (Rs. 59,023 ha^{-1}), NF (Rs. 44,520 ha^{-1}) and CF (Rs. 42,898 ha^{-1}). About 25 per cent cost was reduced under NF compared to RPP.

- Natural farming practice was recorded higher net returns (Rs. 34,649 ha^{-1} and Rs. 49,734 ha^{-1} without and with premium prices, respectively) than other farming practices.

- With premium price, the higher benefit cost ratio was obtained under NF (2.12, which was about 38 per cent higher than RPP and about 20 per cent higher than CF) than CF (1.76), OF (1.70) and RPP (1.54).

3. Validation of different farming practices in ground + Kodo millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- The results found that the higher yield of ground nut and kodo millet were obtained under RPP (13.69 and 5.52qha^{-1}, respectively) than NF (12.53 and 4.46qha^{-1}, respectively), OF (11.32 ha^{-1} and 5.01qha^{-1}, respectively) and CF (10.74qha^{-1} and 4.29qha^{-1}, respectively).

- About 8 per cent and 16 per cent lesser yield of ground nut and kodo millet respectively were obtained under NF than RPP but about 17 per cent and 8 per cent higher yield of ground nut and kodo millet respectively were obtained under NF than CF.

- The lesser cost of cultivation was incurred under CF (Rs. 41,872 ha^{-1}) than NF (Rs. 42,270 ha^{-1}, which was about 22 per cent lower than RPP), RPP (Rs. 56,000 ha^{-1}) and OF (Rs. 54,528 ha^{-1}). About 33 per cent lesser material cost was incurred under NF compared to RPP.

- Without premium price, positive and higher net returns was obtained under NF (Rs. 41,668 ha^{-1}, which was about 15 per cent higher than RPP and about 44 per cent higher than CF) than RPP (Rs. 36,201 ha^{-1}) and other practices. But least net returns were obtained under OF (Rs. 20,421 ha^{-1}).

- Similar trend was seen with premium price but OF became more than CF after additional price. About 52 per cent higher net return was obtained under NF (Rs. 54,975 ha^{-1}) over RPP (Rs. 36,150 ha^{-1}). The benefit cost ratio of system was higher under NF (2.30, which was about 38 per cent higher than RPP and about 36 per cent higher than CF) than CF (1.69), RPP (1.66) and OF (1.63).

4. Validation of different farming practices in Redgram + Barnyard millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- The higher yield of red gram and barnyard millet were obtained under RPP (9.30 and 23.20qha^{-1}, respectively) than NF (7.01 and 21.40qha^{-1}, respectively). The red gram yield along with barnyard millet was better under CF (6.87 ha^{-1}) but barnyard yield was less (17.77qha^{-1}) when compared to OF where barnyard yield (21.40qha^{-1}) was higher than CF and red gram yield was (6.08 ha^{-1}).

- Among the four cultivation practices, the lesser cost of cultivation was incurred under CF (Rs. 37,321 ha^{-1}) than NF (Rs. 42,600 ha^{-1}, which was about 29 per cent lesser than RPP and about 14 per cent higher than CF), RPP (Rs. 60,417 ha^{-1}) and OF (Rs. 76,456 ha^{-1}). About 14 per cent labour costs and about 45 per cent labour cost were saved under NF over RPP.

- Without premium price, higher net returns was obtained under RPP (Rs. 80,763 ha^{-1}) than NF (Rs. 78,458 ha^{-1}) and least was under OF (Rs. 42,183 ha^{-1}).

- With premium price, the net returns obtained were higher under NF (Rs. 1,01,008 ha^{-1}, which was about 25 per cent higher than RPP and about 46 per cent higher than CF) and least was under OF (Rs. 44,735 ha^{-1}). The benefit cost ratio estimated to be higher under NF (3.37) than other practices.

5. Validation of different farming practices in Redgram + Finger millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- The higher yield of red gram and finger millet were obtained under RPP (14.29 and 19.08qha^{-1}, respectively) than OF (12.85 and 16.91qha^{-1}, respectively), NF (11.68 ha^{-1} and 14.99qha^{-1}, respectively) and CF (9.43qha^{-1} and 12.53qha^{-1}, respectively). About 18 per cent of red gram and 21 per cent of finger millet yields were reduced under NF compared to RPP.

- Among the four cultivation practices, the least cost of cultivation was incurred under CF (Rs. 36,788 ha^{-1}) than NF (Rs. 39,699 ha^{-1}), RPP (Rs. 60,942 ha^{-1}) and higher was under OF (Rs. 81,360 ha^{-1}). About 35 per cent lesser cost was incurred under NF over RPP. About 50 per cent input cost was saved under NF over RPP.

- Without premium prices, the net return was higher under RPP (Rs. 1,00,324 ha^{-1}) than NF (Rs. 89,219 ha^{-1}) and least was under OF (Rs. 62,688 ha^{-1}). Natural farming recorded higher benefit cost ratio of 3.25 and least was under OF (1.77).

- With premium prices, the net return was higher under NF (Rs. 1,13,226 ha^{-1}) and least was under CF (Rs. 68,798 ha^{-1}). About 13 per cent and 65 per cent higher net returns obtained under NF over RPP and CF respectively. About 46 per cent higher B:C ratio obtained under NF over RPP.

6. Validation of different farming practices in Redgram + foxtail millet intercropping system during *Kharif* season at College of Agriculture, Hanumanamatti

- The higher yield of red gram along with foxtail millet was obtained under RPP (13.55qha^{-1}) than NF (9.74qha^{-1}), OF (8.02qha^{-1}) and least was under CF (7.17qha^{-1}). About 28 per cent lesser yield was obtained under NF than RPP.

- Natural farming practice registered higher foxtail millet yield (18.86qha^{-1}, which was about 15 per cent higher yield than RPP) than other farming practices.

- Among the four cultivation practices, the least cost of cultivation was incurred under CF (Rs. 37,247 ha^{-1}) than NF (Rs. 41,024 ha^{-1}, which was 30 per cent lower than RPP), RPP (Rs. 58,814 ha^{-1}) and OF (Rs. 76,151 ha^{-1}). About 45 per cent material costs were saved under NF over RPP.

- Without premium price, higher net returns was obtained under NF (Rs. 74,682 ha^{-1}), which was about four per cent higher than RPP and about 29 per cent higher than CF. But the least net returns were obtained under OF (Rs. 12,653 ha^{-1}).

- With premium price, natural farming registered higher net returns (Rs. 96,518 ha^{-1}, which was about 34 per cent higher than RPP and about 66 per cent higher than CF) and least was obtained under OF (Rs. 29,163 ha^{-1}). The higher B: C ratio was under NF (3.35) than CF (2.56), RPP (2.22) and least was under OF (1.38).

KHARIF SEASON AT KVK, HANUMANAMATTI (2019-20)

1. Validation of different farming practices in Finger millet during *Kharif* season at KVK, Hanumanamatti

- Among the different cultivation practice the higher yield was obtained under RPP (21.57qha^{-1}) than OF (17.59qha^{-1}) and NF (16.76qha^{-1}). About 22 per cent lower yield was obtained than RPP.
- The cost of cultivation of finger millet was estimated to be higher under OF (Rs. 73,113 ha^{-1}) than OF (Rs. 50,833 ha^{-1}) and least under NF (Rs. 34,751 ha^{-1}, which was about 32 per cent lower than RPP). About 19 per cent labour cost and about 50 per cent material costs were saved under NF when compared to RPP.
- Without premium price, the net return was higher under RPP practice (Rs. 38,013 ha^{-1}) than NF (Rs. 34,297 ha^{-1}) and negative in case of OF (Rs. -655 ha^{-1}). But the benefit cost ratio was higher under NF (1.99) than other treatments.
- With premium price, the gross return was higher under RPP but the net returns were higher obtained under NF (Rs. 47,035 ha^{-1}) than RPP (Rs. 38,013 ha^{-1}) and OF became positive (Rs. 12,713 ha^{-1}). About 23 per cent higher net return was obtained under NF over RPP. The benefit cost ratio was higher under NF (2.35) than other treatments.

2. Validation of different farming practices in Foxtail millet during *Kharif* season at KVK, Hanumanamatti

- The higher yield of foxtail millet was obtained under RPP (19.68qha^{-1}) than NF (15.56qha^{-1}) and OF (15.56qha^{-1}). About 21 per cent lower yield was obtained under NF than RPP.

- Among the three cultivation practices, the least cost was incurred under NF (Rs. 33,630 ha^{-1}, about 18 per cent lesser cost was incurred under NF than RPP) than RPP (Rs. 40,960 ha^{-1}) and OF (Rs. 49,470 ha^{-1}) practices. About 26 per cent material costs were saved under NF when compared to RPP.

- Without premium price, the higher net returns of Rs. 34,208 ha^{-1} was obtained under RPP than NF (Rs. 25,822 ha^{-1}, about 25 per cent lesser than RPP) and least was under OF (Rs. 6,407 ha^{-1}).

- With premium price, the similar trend was observed under RPP and OF but net returns (Rs. 36,714 ha^{-1}) and benefit cost (2.09) ratio were obtained higher under NF. Even though gross return was lower under NF but its net return was higher among all practices.

3. Validation of different farming practices in Brown top millet during *Kharif* season at KVK, Hanumanamatti

- Among the three cultivation practices, the higher yield of brown top millet was obtained under RPP (15.40qha^{-1}) than NF (14.60qha^{-1}) and OF (13.15qha^{-1}). About five per cent lower yield was obtained than RPP.

- The cost of cultivation of brown top millet was higher under OF (Rs. 48,206 ha^{-1}) than RPP (Rs. 39,176 ha^{-1}) and NF (Rs. 34,154 ha^{-1}). About 13 per cent lesser cost was incurred under NF than RPP.

- Without premium price, the positive and higher net returns were obtained under NF (Rs. 20,450 ha^{-1}, about 11 per cent higher than RPP) and least was under OF (Rs. 971 ha^{-1}).

- With premium price, similar trend was observed in net returns and benefit cost ratios under all three adopted farming practices. About 67 per cent higher net returns were obtained under NF than RPP. Similarly, about 29 per cent higher benefit cost ratio was obtained under NF than RPP.

4. Validation of different farming practices in Barnyard millet during *Kharif* season at KVK, Hanumanamatti

- The higher groundnut yield was recorded under RPP (20.75qha^{-1}) as compared to OF (16.78qha^{-1}) and NF (17.85qha^{-1}, about 14 per cent lower than RPP).

- The study revealed that the cost of cultivation worked out to be Rs. 33,895 per hectare under NF practice which was lower than RPP (Rs. 40,082 ha^{-1}) and OF (Rs. 47,099 ha^{-1}). Cultivation of barnyard under NF was saved about 15 per cent compared to RPP.

- Without premium price, net returns realized were higher in RPP (Rs. 28,472 ha^{-1}) than NF (Rs. 25,367 ha^{-1}) and least in OF (Rs. 8,601 ha^{-1}). Benefit cost ratio was higher under NF (1.75) than other under other practices

- With premium price, the higher net return obtained under NF (Rs. 36,077 ha^{-1}, which was about 27 per cent higher than RPP) than RPP (Rs. 28,472 ha^{-1}) and least was under OF (Rs. 18,669 ha^{-1}). About 21 per cent higher benefit cost ratio was obtained under NF (2.06) over RPP (1.71).

RABI SEASON AT MARS, DHARWAD (2019-20)

1. Validation of different farming practices in Wheat during Rabi season at MARS, Dharwad

- The yield was higher under RPP (21.97qha^{-1}) than OF (12.85qha^{-1}) and least was under NF (10.32qha^{-1}). About 53 and 20 per cent lower yield was obtained under NF over RPP and OF respectively.

- The cost of cultivation was estimated to be higher in OF (Rs. 81,031 ha^{-1}) than RPP (Rs. 66,928 ha^{-1}) and Natural Farming (Rs. 44,153 ha^{-1}). About 34 and 45 per cent lower cost was incurred under NF over RPP and OF respectively. Higher amount of material cost was saved under NF (about 46 and 63 per cent over RPP and OF respectively).

- Without premium price, net returns was estimated to be positive under RPP (Rs. 357 ha^{-1}) and others showed negative returns. The benefit cost ratio was obtained under RPP (1.01) than NF (0.72) and OF (0.49).

- With premium price, the net return remained negative in NF and OF but which was positive under RPP.

2. Validation of different farming practices in Bengal gram during Rabi season at MARS, Dharwad

- Yield of Bengal gram was estimated to be 15.16qha^{-1}, 12.39qha^{-1} and 11.15qha^{-1} under RPP, OF and NF, respectively. About 26 per cent lesser yield was obtained under NF than RPP and about 10 per cent lower than OF.

- Among the three cultivation practices, the least cost was incurred under NF (Rs. 37,537 ha^{-1}) than RPP (Rs. 42,837) and OF (Rs. 42,872 ha^{-1}) practices. About 12 per cent lower costs were incurred to cultivate Bengal gram under NF compared to RPP.

- Without premium price, the higher net return was obtained under RPP (Rs. 24,115 ha^{-1}) than OF (Rs. 12,286 ha^{-1}) and NF (Rs. 12,189 ha^{-1}, which was about 49 per cent lesser than RPP).

- With premium price, the net returns showed similar trend under all methods of farming. About 11 per cent lesser net return was obtained under NF than RPP. The benefit cost ratio was higher under NF (1.57) than RPP (1.56) and OF (1.53).

3. Validation of different farming practices in Sorghum during Rabi season at MARS, Dharwad

- Among three cultivation practice, the higher yield was obtained under RPP (33.91qha^{-1}) than OF (28.92qha^{-1}) and NF (25.94qha^{-1}). About 24 per cent lesser yield was obtained under NF than RPP.

- The cost cultivation was higher under OF (Rs. 70,049 ha^{-1}) than RPP (Rs. 48,036 ha^{-1}) and least under NF (Rs. 31,316 ha^{-1}). About 34 and 55 per cent lower costs was incurred to cultivate sorghum under NF compared to RPP and OF respectively. Material cost was about 55 per cent lower than RPP and 79 per cent lower than OF) than RPP (Rs. 17,778 ha^{-1}) and higher was under OF (Rs. 38,196 ha^{-1}).

- Cost of production was lower under NF (Rs. 1, 207 q^{-1}, which was about 14 per cent lower than RPP) than RPP (Rs. 1,407 q^{-1}) and OF (Rs. 2,399 q^{-1})

- Without premium price the net return was higher under RPP (Rs. 49,600 ha^{-1}) than NF (Rs. 44,606 ha^{-1}) and least in case of OF (Rs. 10,559 ha^{-1}). The benefit cost ratio was higher under NF (2.42) than RPP (2.03) and OF (1.15)..

- The positive and higher net return was obtained under NF after adding premium prices for NF and OF produces than RPP and OF.

4. Validation of different farming practices in bengal gram + linseed intercropping system during Rabi season at MARS, Dharwad

- The higher yield of bengal gram and linseed were obtained under RPP (8.28 and 3.37qha^{-1}, respectively) than OF (7.49 and 1.55qha^{-1}, respectively) and least was under NF (6.34 and 1.24qha^{-1}, respectively). About 23 per cent lower yield was obtained under NF than RPP. Similar trend was seen in case of linseed crop; about 63 per cent lower yield was recorded under NF than RPP.

- Among the three cultivation practices, the lower cost of cultivation was incurred under NF (Rs. 35,377 ha^{-1}) than RPP (Rs. 41,881 ha^{-1}) and OF (Rs. 42,003 ha^{-1}). About 16 per cent cost was saved by cultivating under NF compared to RPP.

- Without premium prices, the positive net return was obtained under RPP (Rs. 11,082 ha^{-1}) only, whereas negative returns was obtained under OF (Rs. -312 ha^{-1}) and NF (Rs. -777 ha^{-1}).

- With premium price, the net return became positive under NF (Rs. 7312 ha^{-1}, which was yet about 49 per cent lesser than RPP) and OF (Rs. 8,003 ha^{-1}). The benefit cost ratio of Bengal gram + linseed intercropping system was higher under RPP (1.26) than OF (1.17) and NF (1.17).

SUMMER SEASON AT MARS, DHARWAD (2019-20)

1. Validation of different farming practices in green gram during summer season at MARS, Dharwad

- The yield of green gram was higher under NF (7.80qha^{-1}) than RPP (6.87qha^{-1}) and OF (6.04qha^{-1}). About 14 per cent higher yield was obtained under NF than RPP and about 29 per cent higher than OF.
- Cost of cultivation of green gram was higher under OF (Rs. 45,365 ha^{-1}) than RPP (Rs. 42,420 ha^{-1}) and least was under NF (Rs. 32,144 ha^{-1}). About 25 per cent cost was saved under NF than RPP. About 47 per cent material costs were saved under NF over RPP. About 33 per cent lower cost of production was incurred under NF than RPP.
- Without premium price, the net returns were higher under NF (Rs. 36,100 ha^{-1}, which was 107 per cent higher than RPP) than RPP (Rs. 17,401 ha^{-1}) and least was under OF (Rs. 7,711 ha^{-1}).
- With premium price, the net returns showed similar trends under all three methods. The higher benefit cost ratio was under NF (2.53) than RPP (1.41) and OF (1.39).

2. Validation of different farming practices in black gram during summer season at MARS, Dharwad

- Higher yield was obtained under Natural farming (6.89qha^{-1}) than OF (6.33qha^{-1}) and RPP (6.08qha^{-1}). About 13 per cent higher yield was obtained under NF than RPP.
- The least cost of cultivation was incurred under NF (Rs. 32,067 ha^{-1}, about 26 per cent lower than RPP) than RPP (Rs. 42,588 ha^{-1}) and OF (Rs. 45,512 ha^{-1}). About 48 per cent material costs were saved under NF over RPP.
- Without premium price, the net return was negative under both RPP (Rs. $^{-1}$56 ha^{-1}) and OF (Rs. $^{-1}$,311 ha^{-1}) but the positive net return was obtained under NF (Rs. 16,074 ha^{-1}).

Similarly, the benefit cost ratio were remained less than one under OF and RPP but which was more than one under NF practice (1.50).

- With premium price, the net return was estimated to be positive under NF (Rs. 24,979 ha^{-1}) and OF (Rs. 6,934 ha^{-1}) but which was remained negative under RPP (Rs. $^{-1}$56 ha^{-1}). About 79 per cent higher benefit cost ratio was obtained under NF than RPP.

3. Validation of different farming practices in ground nut during summer season at MARS, Dharwad

- The higher groundnut yield was recorded under Natural farming (33.67qha^{-1}) as compared to RPP (30.93qha^{-1}) and OF (30.51qha^{-1}) practices. About nine per cent higher yield was obtained under NF than RPP and about 10 per cent higher than OF.
- The cost of cultivation worked out to be Rs. 50,320 per hectare under NF practice which was lower than RPP (Rs. 67,281 ha^{-1}) and OF (Rs. 69,923 ha^{-1}). Natural Farming has resulted in reduction in the cost of cultivation by 25 per cent under NF over RPP. About 43 per cent input costs were saved under NF over RPP .
- The production cost was highest in OF (Rs. 2,292 q^{-1}) than RPP (Rs. 2,175 q^{-1}) and NF (Rs. 1,495 q^{-1}, which was about 31 per cent lesser than RPP).
- Without premium price, the net returns realized was higher in NF (Rs. 1,27,903ha^{-1}, which was about 33 per cent higher than RPP) than RPP (Rs. 96,067 ha^{-1}) and OF (Rs. 91,785 ha^{-1}). Higher b:C ratio was obtained under NF(3.54) than RPP(2.43) and OF (2.31)
- With premium price, net return was estimated to be higher under NF (Rs. 1,62,415 ha^{-1}) than OF (Rs. 1,23,058 ha^{-1}) and comparatively less under RPP (Rs. 96,067 ha^{-1}). About 69 per cent higher net returns were obtained under NF than RPP. About 74 per cent higher benefit cost ratio was obtained under NF than RPP .

KHARIF SEASON AT MARS, DHARWAD (2020-21)

1. Validation of different farming practices in green gram during *Kharif* season at MARS, Dharwad (2020-21)

- The yield of green gram was 5.11qha^{-1} under NF as against 8.34qha^{-1}, 7.67qha^{-1} and 4.91qha^{-1} under RPP, CF and OF, respectively. About 39 and 33 per cent lesser yield was obtained under NF over RPP and CF, respectively.

- The cost of cultivation of green gram was lower under CF (Rs. 35,982 ha^{-1}) than NF (Rs. 38,476 ha^{-1}), RPP (Rs. 46,465 ha^{-1}) and OF (Rs. 48,059 ha^{-1}). It showed about 17 per cent lower cost incurred under NF over RPP. About 38 per cent in input cost was saved under NF compared to RPP and about 7 per cent higher cost incurred over CF.

- Per quintal cost of production of green gram was lower under CF (Rs. 4,,692) which was than RPP (Rs. 5,571 q^{-1}), NF (Rs. 7,528 q^{-1}, which was about 35 per cent higher than RPP and about 60 per cent higher than CF).

- Without premium price, the higher and positive net returns obtained under CF (Rs. 20,972 ha^{-1}) and RPP (Rs. 15,417 ha^{-1}) but which was least under NF (Rs. 592 ha^{-1}) and negative under OF (Rs. $^{-1}$0,225 ha^{-1}). About 24 and 19 per cent lower benefit cost ratio was obtained under NF over RPP and CF respectively.

- With premium price, the similar trend was obtained under all four methods. About 50 per cent lower net return was obtained under NF over RPP and about 64 per lesser than CF. The benefit cost ratio was found to be higher under CF (1.58) than RPP (1.33), NF (1.20) and least was under OF (0.93).

2. Validation of different farming practices in black gram during *Kharif* season at MARS, Dharwad

- The results found that comparatively higher yield was obtained under OF (3.73qha^{-1}) than NF (2.75qha^{-1}, which was about 4 per cent higher than RPP and about 31 per cent higher than CF), RPP (2.65qha^{-1}) and CF (2.10qha^{-1},).

- Among the four cultivation practices, the minimum cost of cultivation was incurred in CF (Rs. 32,537 ha^{-1}, which was about 12 per cent lower than NF) than NF (Rs. 36,367 ha^{-1}, which was about 18 per cent lesser than RPP), RPP (Rs. 44,253 ha^{-1}) and OF (Rs. 46,907 ha^{-1}). Large amount of material cost was saved under NF (about 38 lower than RPP).

- Without premium price, the negative net returns were obtained under all four treatments due to lower yield of black gram. Similar trend was seen even with premium prices considered.

3. Validation of different farming practices in Soybean during *Kharif* season at MARS, Dharwad

- RPP recorded higher yield (37.94qha-1) than OF (33.10qha-1), CF (30.43qha-1) and NF (27.22qha-1). About 28, 11, 18 per cent lower yield was obtained under NF than RPP, CF and OF, respectively.

- The cost of cultivation was higher under OF (Rs. 69,362 ha-1) than RPP (Rs. 65,382 ha-1), CF (Rs. 50,611 ha-1) and least was under NF (Rs. 47,118 ha-1, which was about 28 per cent lesser than RPP). About 43 and 17 per cent material and labour costs respectively were saved under NF compared to RPP.

- Without premium price, net returns was higher under RPP (Rs. 99,932 ha-1) than CF (Rs. 75,885 ha-1), OF (Rs. 74,609 ha-1,) and NF (Rs. 71,764 ha-1, which was about 28 per cent lesser than RPP). With the same price, higher benefit cost ratio was obtained under RPP(2.53) than NF (2.52) , CF (2.50) and OF (2.08).

- With premium price, higher net returns obtained under OF (Rs. 1,01,521 ha-1) than RPP (Rs. 99,932 ha-1), NF(Rs. 93,893 ha-1, which was about 6 per cent higher than RPP and 24 per cent higher than CF) and OF (Rs. 75,885 ha-1). Higher benefit cost ratio was obtained under NF (2.99) than RPP(2.53), CF (2.50) and OF (2.46).

4. Validation of different farming practices in maize during *Kharif* season at MARS, Dharwad

- RPP recorded significantly higher grain yield (65.85qha-1) over CF (50.87qha-1), NF (33.12qha-1) and least was under NF (25.68qha-1) systems. About 61 per cent lesser yield was obtained under NF than RPP, about 50 per cent lower yield than CF and about 22 per cent lower yield than OF.

- Cost of cultivation was higher under OF (Rs. 89,294 ha-1) and least was in NF (Rs. 50,126 ha-1, which was about 36 per cent lesser than RPP). About 54 per cent material costs and about 22 per cent labour cost were saved under NF compared to RPP. Least production cost was incurred under CF (Rs. 1,131 q-1) over other practices.

- Without premium price, net returns was higher under RPP (Rs. 36,129 ha-1) than CF (Rs. 32,608 ha-1), NF (Rs. 563 ha-1, which was about 98 per cent lesser than RPP) and negative was obtained under OF (Rs. -36,899 ha-1). About 31 per cent lower benefit cost ratio was obtained under NF over RPP.

- With premium price, higher net returns showed similar trend. Higher benefit cost ratio was obtained under CF (1.57) than RPP (1.46), NF (1.16) and OF (0.82).

5. Validation of different farming practices in maize and soybean intercropping system during *Kharif* season at MARS, Dharwad

- The higher yield of maize and soybean were obtained under RPP (28.37 and 15.05qha-1, respectively) than CF (22.67 and 13.70qha-1, respectively), OF (20.71 and 9.72qha-1, respectively) and least was under NF (16.66 and 9.65qha-1, respectively).

- About 41 per cent and 36 per cent lesser yield of maize and soybean respectively was obtained under NF than RPP. About 26 per cent and 30 per cent lesser yield of maize and soybean respectively was obtained under NF than CF.

- Among the four cultivation practices, the least cost of cultivation was incurred under NF (Rs. 51,227 ha-1, which was about 27 per cent lesser than RPP) than CF (Rs. 57,498 ha-1), RPP (Rs. 70,115 ha-1) and OF (Rs. 79,311 ha-1). About 8 per cent of labour cost and 49 per cent of material costs were saved under NF compared to RPP.

- Without premium price, the higher net return were obtained under RPP (Rs. 48,579 ha-1) than CF (Rs. 45,576 ha-1), NF (Rs. 21,327 ha-1, which was about 56 per cent lesser than RPP and about 53 per cent lesser than CF) and least was under OF (Rs. 119 ha-1). Higher benefit cost ratio was obtained in CF (1.79) than RPP (1.69), NF (1.42) and OF (1.01).

- With the premium price, the net returns and benefit cost ratios showed similar trend as without premium price. Higher benefit cost ratio was obtained in CF (1.79) than RPP (1.69), NF (1.66) and OF (1.17).

6. Validation of different farming practices in Red gram + Soybean intercropping system during *Kharif* season at MARS, UAS, Dharwad

- Higher yield of red gram with soybean were obtained under RPP (13.11 and 16.19qha-1, respectively) than CF (11.54 and 13.65qha-1, respectively), OF (8.41 and 10.88qha-1, respectively) and least was under NF (7.66 ha-1 and 13.94qha-1, respectively).

- About 36 per cent and 33 per cent lesser yields of red gram and soybean respectively were obtained under NF than RPP. About 27 per cent and 20 per cent lesser yields of red gram and soybean respectively were obtained under NF than CF. About 9 per cent higher and 22 per cent lesser yields of red gram and soybean respectively were obtained under NF than OF.

- The lesser cost of cultivation was incurred under NF (Rs. 56,572 ha-1, which was about 28 per cent lesser than RPP) than CF (Rs. 61,447 ha-1), RPP (Rs. 78,251 ha-1) and OF (Rs. 94,429 ha-1). The huge amount of material cost was saved under NF (About 44 per cent than RPP and about 60 per cent than OF).

- Without premium price, higher net returns was obtained under RPP (Rs. 78,563 ha-1) than CF (Rs. 74,393 ha-1), NF (Rs. 47,601 ha-1, about 39 per cent lesser than RPP and about 36 per cent lesser than CF) and least was under OF (Rs. 17,250 ha-1). Higher benefit cost ratio was under CF (2.21) than RPP (2.00), NF(1.84) and OF(1.18).

- Net returns showed similar trend with premium price but the benefit cost ratio was higher under CF (2.21) than NF(2.18), RPP(2.00) and OF (1.40).

7. Validation of different farming practices in Red gram + Maize intercropping system during *Kharif* season at MARS, UAS, Dharwad

- The higher yield of red gram plus maize were obtained under RPP (10.13 and 36.18qha-1, respectively) than CF (9.21 and 26.66qha-1, respectively), OF (6.97 and 15.44qha-1, respectively) and least was under NF (6.56 ha-1 and 12.11qha-1, respectively).

- About 35 per cent and 67 per cent lesser yields of red gram and maize respectively were obtained under NF than RPP. About 29 per cent and 55 per cent lesser yields of red gram and maize respectively were obtained under NF than CF. About 6 and 28 per cent lesser yields of red gram and maize respectively were obtained under NF than OF.

- The less cost of cultivation was incurred under NF (Rs. 53,209 ha-1, which was about 38, 21 and 51 per cent lesser than RPP, CF and OF respectively. About 50 and 67 per cent material costs were saved under NF than RPP and OF respectively.

- Without premium prices, positive net returns were obtained under RPP (Rs. 44,154 ha-1), CF (Rs. 42,590 ha-1) and NF (Rs. 14,896 ha-1, about 66 per cent lesser than RPP). But the negative net returns were obtained under OF (Rs. -32,553 ha-1). Higher benefit cost ratio was found in CF (1.64) than RPP (1.52), NF (1.28) and OF (0.70).

- Similar trend was seen with premium price also, the higher net return was obtained under RPP (Rs. 44,154 ha-1,) than CF, NF and negative return was under OF. About 40 per cent lesser net returns were obtained under NF than RPP.

8. Validation of different farming practices in Cotton + Ground nut intercropping system during *Kharif* season at MARS, UAS, Dharwad

- The higher yield of cotton and ground nut were obtained under RPP (5.40 and 17.21qha-1, respectively) than NF (5.23 and 16.71qha-1, respectively) and least was under OF (4.55 ha-1 and 15.55qha-1, respectively).

- Least cost of cultivation was incurred under NF (Rs. 71,460 ha-1, which was about 19 per cent lesser than RPP and 28 per cent lesser than OF) than CF (Rs. 71,876 ha-1), RPP (Rs. 88,160 ha-1) and highest was under OF (Rs. 98,559 ha-1). About 27 per cent material cost was lower than RPP and about 35 per cent lower than OF.

- Without premium price, higher net returns was obtained under CF (Rs. 54,046 ha-1) than NF (Rs. 52,615 ha-1, about 23 per cent higher than RPP), RPP (Rs. 42,779 ha-1). But the least net returns were obtained under OF (Rs. 15,474 ha-1). The high benefit cost ratio was observed under CF (1.80) than NF (1.74), RPP (1.49), OF (1.16)

- With premium price, the higher net returns was obtained under NF (Rs. 75,615 ha-1, which was about 78 per cent higher than RPP and about 40 per cent higher than CF) than CF (Rs. 54,046 ha-1), RPP (Rs. 42,779 ha-1) but least return was under OF (Rs. 36,524 ha-1). The high benefit cost ratio was observed under NF (2.06) than CF (1.80), RPP (1.49), OF (1.37)

KHARIF SEASON AT COLLEGE OF AGRICULTURE, HANUMANAMATTI (2020-21)

1. **Validation of different farming practices in ground nut + finger millet intercropping system during Kharif season at College of Agriculture, Hanumanamatti**

- Natural farming registered higher yield of ground nut (15.32qha-1) than RPP (14.55qha-1), OF (13.85q-1ha-1) and CF (11.82qha-1). Higher yield of finger millet obtained under RPP (7.51qha-1) than CF (6.24qha-1), OF (6.08qha-1) and NF (5.53qha-1).

- Cost of cultivation was lesser under CF (Rs. 49,002 ha-1) than NF (Rs.50,581 ha-1) than RPP (Rs. 66,910 ha-1) and OF (Rs. 70,704 ha-1). About 24 per cent cost were saved under NF than RPP. The material cost was saved under NF (Rs. 19,277 ha-1, which was about 34 per cent lesser than RPP and about 39 per cent lesser than OF).

- Without premium prices, net return was higher under NF (Rs. 54,434 ha-1, which was about 36 per cent higher than RPP and about 85 per cent higher than OF) than (Rs. 39,881 ha-1), CF (Rs. 39,779 ha-1) and OF (Rs. 29,369 ha-1). The highest benefit cost ratio was under NF (2.02) than CF (1.81), RPP (1.60) and OF (1.42).

- With premium prices, NF registered higher net returns of Rs. 73,092 per hectare (which was about 83 per cent higher than RPP and about 56 per cent higher than OF) than RPP, CF and OF. The highest benefit cost ratio was obtained under NF (2.45) than CF (1.81), OF (1.66) and RPP (1.60).

2. **Validation of different farming practices in Groundnut + Brown top mille intercropping system during Kharif season at College of Agriculture, Hanumanamatti**

- Higher yield of groundnut and brown top millet were obtained under NF (13.13 and 5.15qha-1, respectively) than CF (12.68and 5.14qha-1, respectively), OF (12.56 and 5.28qha-1, respectively) and RPP (12.53 and 5.24qha-1, respectively).

- Cost of cultivation was higher under OF (Rs. 64,585 ha-1) than RPP (Rs. 63,293 ha-1), NF (Rs. 48,447 ha-1) and CF (Rs. 45,681 ha-1). About 24 and 25 per cent costs were reduced under NF over RPP and OF respectively. Material cost was higher in RPP (Rs. 28,465 ha-1) and least was under CF (Rs. 15,988 ha-1) and NF (Rs. 19,094 ha-1, which was about 33 per cent lower than RPP).

- Without premium prices, NF was superior and recorded higher net returns (Rs. 45,148 ha-1) than other RPP and OF. The higher benefit cost ratio was under CF (2.27) than NF (1.93), RPP (1.42) and OF (1.41).

- NF practice was superior and recorded higher net returns (Rs. 61,755 ha-1, with premium prices) than other farming practices. The higher benefit cost ratio was under NF (2.27, than CF (2.01), OF (1.66) and RPP (1.42).

3. Validation of different farming practices in Groundnut + Kodo millet intercropping system during Kharif season at College of Agriculture, Hanumanamatti

- Higher yield of ground nut and kodo millet were obtained under NF (13.97 and 4.36qha-1, respectively) than RPP (13.37 and 4.96qha-1, respectively), OF (13.23ha-1 and 4.46qha-1, respectively) and CF (13.05qha-1 and 4.51qha-1, respectively).

- The lesser cost of cultivation was incurred under CF (Rs.46,260 ha-1) than NF (Rs. 49,401 ha-1, which was about 19 per cent lower than RPP), RPP (Rs.60,854 ha-1) and OF (Rs. 61,879 ha-1). About 19 and 20 per cent lesser cost was incurred under NF compared to RPP and OF respectively.

- Without premium price, higher net returns was obtained under NF (Rs. 46,709 ha-1, which was about 38 per cent higher than RPP and 54 per cent higher than OF) than other practices.

- With premium price, the net return was higher in NF (Rs. 63,739 ha-1, which was about 89 per cent higher than RPP and about 36 per cent higher than OF). The benefit cost ratio of the system was higher under NF (2.29) than CF (2.00), OF (1.75) and RPP (1.55).

4. Validation of different farming practices in Red gram + Barnyard millet intercropping system during Kharif season at College of Agriculture, Hanumanamatti

- The higher yield of red gram with barnyard millet was under RPP (8.37qha-1) than OF (7.56qha-1), NF (6.67qha-1) and CF (6.58qha-1). The barnyard yield was better under NF (16.57qha-1) but which was least under CF (15.36qha-1).

- The less cost of cultivation was incurred under CF (Rs. 36,915ha-1) than NF (Rs. 42,185 ha-1, which was about 26 per cent lesser than RPP and about 45 per cent lesser than OF), RPP (Rs. 59,623 ha-1) and OF (Rs. 80,196 ha-1). The material cost incurred was lower under CF (Rs. 12,743 ha-1) and NF (Rs. 15,310 ha-1, which was about 45 per cent lesser than RPP, about and about 69 per cent lesser than OF).

- Without premium price, higher net return was obtained under CF (Rs. 61,582 ha-1) and NF (Rs. 61,499 ha-1) than RPP (Rs. 54,970 ha-1) and OF (Rs. 27,261 ha-1). The B:C ratio was higher under NF (2.67) than other three practices.

- With premium prices, net return was higher under NF (Rs. 79,750 ha-1) than CF (Rs. 61,582 ha-1), RPP (Rs. 54,970 ha-1) and OF (Rs. 46,099 ha-1). About 69 per cent higher net return was obtained under NF over OF and about 42 per cent higher than RPP and about 69 per cent higher than OF. The B:C ratio higher under NF (2.89) and least was under OF (1.57).

5. Validation of different farming practices in Red gram + Foxtail millet intercropping system during Kharif season at College of Agriculture, Hanumanamatti

- The higher yield of red gram along with foxtail millet was obtained under RPP (9.91qha-1) than NF (8.42qha-1), OF (7.85qha-1) and least was under CF (7.31qha-1). Natural farming registered higher foxtail millet yield (16.28qha-1) than CF (15.32qha-1), RPP (15.02qha-1) and least was under OF (12.01qha-1).

- The less cost of cultivation was under CF (Rs. 37,092 ha-1) and NF (Rs. 40,681 ha-1, which was 30 per cent lesser than RPP and about 50 per cent lower than OF) than RPP (Rs. 58,148 ha-1) and OF (Rs. 81,559 ha-1). About 45 per cent material costs were saved under NF over RPP and about 65 per cent over OF.

- Without premium prices, higher net return was obtained under NF (Rs. 70,217 ha-1) than CF (Rs. 64,559 ha-1), CF (Rs. 60,685 ha-1) and OF (Rs. 13,189 ha-1). The higher B: C ratio showed under NF (2.73) and least was under OF (1.16).

- With premium price NF registered higher net returns (Rs. 90,480 ha-1, which was 49 per cent higher than RPP and 40 per cent higher than CF) and least was under OF (Rs. 30,178 ha-1). The higher B: C ratio was higher under NF (3.22) than CF (2.74), RPP (2.04) and OF (1.37).

6. Validation of different farming practices in Red gram + Finger millet intercropping system during Kharif season at College of Agriculture, Hanumanamatti

- The higher yield of red gram and finger millet were obtained under RPP (9.21 and 17.52qha-1, respectively) than OF (9.70 ha-1 and 15.53qha-1, respectively), NF (8.73 ha-1 and 13.77qha-1, respectively) and CF (8.15qha-1 and 13.70qha-1, respectively).

- The less cost of cultivation was incurred under CF (Rs. 36,636 ha-1) and NF (Rs. 39,143ha-1), than RPP (Rs. 61,177ha-1) and higher was under OF (Rs. 88,218 ha-1). About 36 and 56 per cent lower costs were incurred under NF than RPP and OF respectively. About 51 and 69 per cent material costs were saved under NF over RPP and OF respectively.

- Without premium prices, the net return was higher under NF (Rs. 63,703 ha-1) and CF (Rs. 61,449 ha-1) than RPP (Rs. 56,668ha-1) and OF (Rs. 25,860 ha-1). Higher benefit cost ratio was under CF (2.68) and NF (2.63) than RPP (1.93) and OF (1.29). Similar trend was seen with premium prices for OF and NF produces.

- With premium prices, about 78, 44 and 33 per cent higher net returns were obtained under NF over OF, RPP and CF, respectively. The benefit cost ratio of the system was higher under NF (3.09) than CF (2.68), RPP (1.93) and OF (1.52).

RABI SEASON AT MARS, DHARWAD (2020-21)

1. Validation of different farming practices in Wheat during Rabi season at MARS, Dharwad

- The yield was recorded higher under RPP (21.55qha-1) than CF (19.30qha-1), OF (15.65qha-1) and least was under NF (12.13qha-1). About 44 per cent lower yield was obtained under NF than RPP and about 22 per cent lesser than OF.

- The cost of cultivation were higher in OF (Rs. 80,675 ha-1) than RPP (Rs. 61,374 ha-1), CF (Rs. 47,010 ha-1) and NF (Rs. 44,185 ha-1). About 28 and 45 per cent lower costs were incurred to under NF than RPP and OF respectively. The higher amount of material cost was saved under NF (about 39 per cent than RPP and 63 per cent than OF).

- Production cost was higher under OF (Rs. 5,155 q-1) and least was under CF (Rs. 2,436 q-1). About 28 per cent higher under NF than RPP and about 50 per cent higher than CF.

- Without premium prices, the negative net returns were obtained under OF (Rs. -35,925 ha-1) and NF (Rs. -9,467 ha-1) , whereas positive net returns were obtained

under RPP (Rs. 55 ha-1) and CF (Rs. 7,858 ha-1) . The B: C ratio was higher under CF (1.17) than RPP (1.00) and least under NF (0.79) and OF (0.55).

- With premium prices, the net returns and benefit cost ratios showed similar trend as under without premium prices.

2. Validation of different farming practices in Bengal gram during Rabi season at MARS, Dharwad (2020-21)

- The yield was recorded higher under RPP (21.55qha-1) than CF (19.30qha-1), OF (15.65qha-1) and least was under NF (12.13qha-1). About 44 per cent lower yield was obtained under NF than RPP and about 37 per cent lesser than CF.

- The least cost of cultivation was incurred under NF (Rs. 40,004 ha-1) than CF (Rs. 40,873 ha-1), RPP (Rs. 46,721 ha-1) and OF (Rs. 47,525 ha-1) practices. About 14 per cent lower costs were incurred under NF over RPP. Material cost was estimated to be only Rs. 14,930 per hectare under NF which was about 8 less than RPP. About 51 per cent higher production cost was incurred under NF compared to RPP due to drastic reduction in the yield under NF.

- Without premium price, net returns of Rs. 77,285 ha-1, Rs. 71,443 ha-1, Rs. 32,190 ha-1 and Rs. 30,888 ha-1 were recorded under RPP, CF, OF and NF, respectively. About 60 per cent lesser net returns were obtained under NF than RPP and about 57 per cent lesser than CF. The benefit cost ratio were higher under CF (2.75) and least was under OF (1.68).

- With premium price, the net returns and benefit cost ratios showed similar trend in all four s of farming. The B: C ratio remains higher under CF (2.75) than RPP (2.65), NF (2.11) and OF (2.00).

3. Validation of different farming practices in Sorghum during Rabi season at MARS, Dharwad

- Among the different cultivation practice the higher yield was obtained under RPP (24.15qha-1) and least was under NF (11.08qha-1). About 54 per cent lesser yield was obtained under NF than RPP and about 45 per cent lesser than CF.

- The cost of cultivation incurred was higher under OF (Rs. 69,133 ha-1) and least was under NF (Rs. 29,934 ha-1). About 38 per cent lower costs were incurred to cultivate sorghum under NF compared to RPP. About 55 per cent material costs and about 26 per cent in labour costs were saved under NF over RPP.

- Without premium prices, net return was higher under CF (Rs. 33,964 ha-1) than RPP (Rs. 33,071 ha-1), NF (Rs. 13,527 ha-1) and negative in OF (Rs. -21,357 ha-1). The benefit cost ratio was higher under CF (1.97) than RPP (1.69), NF (1.45) and least was under OF (0.69).

- With premium prices, positive and higher net returns were obtained under RPP than CF, NF and which was remained negative under OF practice. About 42 per cent lesser net returns were obtained under NF than RPP.

4. Validation of different farming practices in Bengal gram + linseed intercropping system during Rabi season at MARS, Dharwad

- The results found that the higher yield of Bengal gram and linseed were obtained under RPP (18.36 and 3.37qha-1, respectively) and least was under NF (10.77 and 2.06qha-1, respectively). About 41 per cent lower Bengal gram yield was obtained under NF than RPP and only about 5 per cent lesser than OF. About 39 per cent lower linseed yield was recorded under NF than RPP and about 27 per cent lesser than OF.

- The lower cost of cultivation was incurred under NF (Rs. 37,952 ha-1) and higher was under RPP (Rs. 46,839 ha-1). About 19 and 18 per cent costs were saved under NF compared to RPP and OF respectively. About 16 and 19 per cent material costs were saved under NF over RPP and OF respectively.

- Without premium prices, the higher net return was obtained under RPP (Rs. 64,928 ha-1) than CF (Rs. 54,890 ha-1), NF (Rs. 29,255 ha-1, which was about 55 per cent lesser than RPP and about 8 per cent higher than OF) and least was under OF (Rs. 26,905 ha-1). The benefit cost ratio was higher under RPP (2.39) than CF (2.20), NF (1.77) and OF (1.56).

- With premium price the net returns under NF (Rs. 41850 ha-1, which was yet 36 per cent lesser than RPP), OF (Rs. 40645 ha-1), CF (Rs. 54890 ha-1) and highest was under RPP (Rs. 64928 ha-1).

SUMMER SEASON AT MARS, DHARWAD (2020-21)

Validation of different production system in different crops during summer season (2020-21)

1. **Validation of different farming practices in black gram during summer season at MARS, Dharwad**

- The higher black gram yield was recorded under RPP (7.18qha-1) than NF (7.04qha-1), OF (6.56qha-1) and CF (6.42qha-1) practices.
- Cost of cultivation was least under NF (Rs. 36,331ha-1) than OF (Rs. 45,124 ha-1) and RPP (Rs. 43,472 ha-1). But, CF (Rs. 34,013ha-1) registered lowest cost of cultivation than other three s of farming. Natural Farming has resulted in reduction in the cost of cultivation of black gram by 16 per cent than RPP and 19 per cent than OF.
- The production cost of black gram was highest in OF (Rs. 6,879 q-1) and RPP (Rs. 6,055 q-1) than NF (Rs. 5,161 q-1) and CF (Rs. 5,298 q-1). About 15 per cent lower production cost was incurred under NF than RPP and about 25 per cent than OF.
- With premium prices, the net returns was higher in NF (Rs. 16,166 ha-1) than CF (Rs. 13,926 ha-1), RPP (Rs. 10,251ha-1) and OF (Rs. 3,983 ha-1). About 58 per cent higher net return was obtained under NF than RPP. Similarly, the benefit cost ratio was higher under NF (1.44) than CF (1.41), RPP (1.24) and least was under OF (1.09).
- With premium prices, the similar trend was seen in net returns and B:C ratio under all four methods of farming. The benefit cost ratio was estimated to be higher under NF (1.71) than CF (1.41), OF (1.29) and OF (2.24).

2. **Validation of different farming practices in ground nut during summer season at MARS, Dharwad (2020-21)**

- The higher yield was recorded under NF (34.80qha-1) than RPP (32.94qha-1), OF (31.78qha-1) and CF (28.60qha-1).
- Among the four cultivation practices, the minimum cost of cultivation was incurred in CF (Rs. 53,721 ha-1) and NF (Rs. 57,804 ha-1) than RPP (Rs. 68,450 ha-1) and OF (Rs. 71,847 ha-1). Material costs were lower under CF (Rs. 19,151 ha-1) and NF (Rs. 21,086 ha-1) but which was higher under RPP (Rs. 31,224 ha-1) and OF (Rs. 35,042 ha-1). About 32 and 40 per cent material costs were saved under NF over RPP and OF, respectively.
- Without premium price, the higher net return was obtained under NF (Rs. 130,780 ha-1) over other farming method. About 18 and 31 per cent higher net returns were under NF over RPP and OF, respectively. The benefit cost ratio was higher under NF (3.26) than CF (2.89), RPP (2.62) and OF (2.39).
- With premium prices, the higher net return obtained under NF (Rs. 1,66,833 ha-1, which was 51 per cent higher than RPP and about 25 per cent higher than OF) than OF (Rs.

1,33,078 ha-1), RPP (Rs. 1,10,639ha-1) and OF (Rs. 1,01,547 ha-1). The higher benefit cost ratio was under NF (3.89) than CF (2.89), OF (2.85) and least was under RPP (2.62).