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ASIAN AGRI-HISTORY FOUNDATION
PANTNAGAR



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Chief Editor's Remarks

Agriculture in India is not of recent origin, it began by 9000 BC and has a lot of inherited sustainable practices passed through generations. The great epics of ancient India convey the depth of knowledge possessed by the older generations of the farmers of India and constitute the foundation for contemporary and future agricultural innovations and technologies, and hence need to be revived and understood. Asian Agri-history Foundation over the past couple of decades has led this important initiative of bringing to the fore our accumulated agriculture experiences of millennia so that the scientific principle/basis behind them could be properly understood and utilized in sustaining our agriculture production systems for future generations. Let us all do our share in this necessary endeavor.

- J Kumar

Famous agricultural scientists of India (contd.)

(Courtesy: SPS Beniwal, Chairman, AAHF; Source: Chronology of Indian Agricultural Heritage (30,000BCE to 2000CE), Asian Agri-History Foundation, GBPUAT, Pantnagar)

Dr. Chandrakant T. Patel (11 July 1917-25 December 1990) was born in Sarsa village of Khaira district of Gujarat. He was a cotton scientist and successfully worked out method to produce world's first cotton hybrid, known as Hybrid-4 (Sankar-4), in 1970. The hybrid was successfully cultivated commercially in the states of Gujarat and Maharashtra in India giving more than twice the yields of other varieties and was a turning point in the Indian cotton development programme. It was later adopted worldwide. For this valuable contribution, he is known as the Father of Hybrid cotton.



He had obtained his M.Sc. from Bombay University in 1956 and was awarded an honorary D.Sc. degree by Sardar Patel University in 1978. He worked at Surat Agricultural University where he

developed the cotton hybrid. Dr. Patel received the Hari Om Ashram Award, Indian Civilian honour, Tata Endowment Award, Federation of Gujarat Mills and Industry Award, and several other awards for his scientific contributions. Dr Patel died in 1990 as a result of a car accident.

Dr Dilbagh Singh Athwal (12 October 1928-14 May 2017) was born in Kalyanpur village in Punjab. He was a geneticist, plant breeder and agriculturist, known to have conducted pioneering research in plant breeding.



Dr Athwal developed world's first grain pearl millet hybrid named Hybrid Bajra 1 (HB-1) in 1965, which marked the dawn of a new era in pearl millet breeding. He is also one of the stalwarts who laid the foundation of Green Revolution in India. Dr. Athwal and his team selected PV-18, a very high yielding, red grained wheat variety (released in 1966) which initiated Green Revolution in the Punjab state. His another line, which he named Kalyan after his village Kalyanpur, was later released as 'Kalyan Sona', an amber grained, semi-dwarf wheat variety selected at PAU, Ludhiana and released as 'Kalyan Sona' in 1967. This variety occupied the largest area under a single wheat variety at that time and remained popular for more than 10 years.

Dr. Athwal received his Bachelor degree in 1948 from Punjab University and Master's degree in Public Administration from Harvard University, USA. He obtained his Doctoral degree in Genetics and Plant Breeding from the University of Sydney, Australia in 1955. Contributions of Dr. Athwal were recognized by awarding him a number of prestigious awards including Padma Bhushan, Shanti Swarup Bhatnagar Memorial Award, Punjab Krishak Samaj Medal, etc. Dr. D.S. Athwal left for his heavenly abode on Wednesday, the 17 May, 2017 at the age of 89 years.

Dr. Norman E. Borlaug (1914 March-12 September 2009) born in Cresco, Iowa, United States was the creator of dwarf Mexican wheat genotypes with high yield potential. These genotypes were shared with many developing countries including India.

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Managing Editor: **Dr SPS Beniwal**

It was through testing of these genotypes by the major wheat research centres in India that led to development of high yielding wheat varieties and their large-scale seed production that helped increase productivity and production of wheat in India. Thus, it was Dr Norman Borlaug's Mexican wheat genotypes and his guidance and the efforts of Indian agricultural research system that led to development of several wheat varieties that led to "Green Revolution" in India. Among the developing countries in the world India was the major beneficiary of Green Revolution. About the same time, IRRI brought in a high yielding rice variety, IR-8 and that also boosted India's annual production of these two crops. At the same time, soybean and hybrid maize received attention because of the great success in wheat and rice crops.



He had received B.Sc., M.S. and Ph.D. from the University of Minnesota, United States. Dr Borlaug had received a number of awards and honours during his professional career. The most important was the Nobel Peace Prize in 1970 for his pioneering work on Mexican dwarf wheats that led to extensive increases in agricultural production termed the Green Revolution. He is the only agricultural scientist so far to have won the Nobel Prize for ensuring peace in the developing world due to self-reliance in grain production. Although he received a number of other awards and honours which included Presidential Medal of Freedom, Vannevar Bush Award, Public Welfare Medal, World Food Prize, National Medal of Science, Congressional Gold Medal, and Padma Vibhushan in 2006. He is best known for Green Revolution and World Food Prize.

Asian Agri-History Foundation at Pantnagar

(Courtesy: Dr. SPS Beniwal, Chairman, Asian Agri-History Foundation, College of Agriculture, Pantnagar)

As per the strong wish of late Dr. YL Nene, the founder Chairman of Asian Agri-History Foundation (AAHF), and the support of its trustees and its then Chairman Dr SPS Beniwal, and the GBPUA&T administration, the Headquarter (HQ) of AAHF was established at GBPUA&T with effect from 1 June 2019. This was done under an agreement between AAHF and GBPUA&T wherein the University would host AAHF in Pantnagar and provide the required office space and facilities to AAHF and would also nominate a senior faculty member of College of Agriculture to work as the Executive Secretary of AAHF at Pantnagar with Dr SPS Beniwal as its Chairman. Thus, the AAHF HQ was hosted in the College of Agriculture with the Dean Agriculture as the Co-Patron and the Vice-Chancellor of GBPUA&T as the Patron of the Joint AAHF HQ in Pantnagar.

One of the major objectives of establishing the AAHF HQ at Pantnagar was to provide a boost to the required research activities pertaining to Vrikshayurveda practices in agriculture so that questions on how and why part of the successful use of Vrikshayurveda-based Herbal Kunapajala, developed by AAHF,

could be answered through the joint research efforts by the faculty at Pantnagar and the AAHF expertise.

A two-day workshop organized at Pantnagar. The first joint activity that was organized by AAHF, GBPUA&T and the UC-AAHF (Uttarakhand Chapter of AAAHF) was for Uttarakhand as a two-day workshop in conjunction with the Silver Jubilee Anniversary of AAHF on "Vrikshayurveda and Traditional Practices in Uttarakhand State: Present Status and Future Potential", 23-24 October 2019 in the College of Agriculture, GB Pant University of Agriculture and Technology (GBPUA&T), Pantnagar to assess the present status on the use of Vrikshayurveda practices and future potential for their use for the smallholder farmers of Uttarakhand state. The workshop was co-sponsored by the Department of Agriculture, the Horticultural Mission, and Tea Board of the Ministry of Agriculture of the state of Uttarakhand. The workshop was attended by over 110 participants which included 65 smallholder farmers from different districts of Uttarakhand; four NGOs, District Agricultural Officers/their representatives of the Department of Agriculture from different districts; District Horticultural Officers/their representatives from different districts; Tea garden officers from the Uttarakhand Tea Board; invited technical experts on Vrikshayurveda from Rajasthan, West Bengal, and Kerala; members of the UC-AAHF; faculty members of the Departments of the College of Agriculture; five trustees of AAHF; and invited guests.

Prior to the Workshop, a 1-day pre-Workshop Preparatory/Orientation Meeting was organized with the officers of the State Dept of Agriculture, Horticulture Mission, Tea Board, and Coordinators of KVKs of GBPUA&T in Uttarakhand in the College of Agriculture on 1 October 2019.

The Workshop participants were exposed to the successful work done on Vrikshayurveda practices by AAHF's West Bengal on tea, and AAHF's Kerala Chapter on different crops in Kerala. A practical on "How to prepare Kunapajala?" was also conducted for the benefit of participants in the morning of 24 October to provide a hands-on training to participants, in which farmers showed a keen interest, raised a number of pertinent questions, and very much appreciated this practical exercise.

Based on the workshop deliberations and discussions, it was agreed that: (i) Vrikshayurveda practices have great relevance, potential and strength for use in the sustainable agriculture of the smallholder farmers of the hilly areas of Uttarakhand, (ii) the modified version of the fermented liquid fertilizer – Kunapajala - described in Surapala's Vrikshayurveda (c. 1000 CE) named Herbal Kunapajala by AAHF could be extremely useful and effective in ensuring the proper crop/plant nourishment and their protection in eco-friendly manner from insect-pests and diseases, and in maintaining good soil health and thus helping in increasing crop productivity as shown by AAHF's practical experiences in Darjeeling and Dooars tea gardens of northern West Bengal state, and Kerala state, (iii) there was a significant role of Herbal

Kunapajala in enhancing crop productivity of “Jaivik Kheti”, as lower crop productivity problem was highlighted as a major problem faced by the farmer participants who have been practicing it for the last several years, and (iv) based the work-plan that was prepared and presented in the workshop in the Plenary Session based on the discussions and conclusions which was approved by the participants including the locations of work and their crops, a new project now be developed by AAHF for further discussion and finalization and submission for financial support from the Uttarakhand government. The proposed project, after its approval and receiving funding from the Uttarakhand government, would be jointly implemented by AAHF, GBPUA&T, Ministry of Agriculture (Departments of Agriculture, Horticulture Mission and Tea Board, and NGOs.

As a consequence of the Workshop, a WhatsApp group for the workshop participants was created for facilitating information exchange and interaction among the participants. The group served a very useful tool to interact with the group participants especially during the COVID-19 periods in 2020 and 2021. It has been heartening to learn that farmers who adopted Herbal Kunapajala for use in their crops immensely benefited from its use.

Vrikshayurveda Research at Pantnagar

(Courtesy: Dr Sunita T Pandey, Professor Agronomy & Executive Secretary, Asian Agri-History Foundation GBPUAT)

Crops related research. The research work on Vrikshayurveda-based practices was started at GBPUA&T, Pantnagar after the transfer of AAHF Headquarter to Pantnagar in June 2019 and after organizing a 2-day workshop in October 2019, mentioned above. Beginning was made with Herbal Kunapjal, the AAHF modified version of original Kunapjal described in Vrikshayurveda by Surapala (c. 1000 CE). The effectiveness of Herbal Kunapjal was evaluated for its effects on quantity and quality of various crops viz. chickpea, mustard, potato, Tulsi, gladiolus, the medicinal crop *Metricaria chamomilla*, etc. The experiments were conducted in the research programme of the project “Exploring Livelihood Potential of Wild Growing Stinging Nettle (*Urtica dioica*) in Uttarakhand” under the advisement and technical guidance of Dr. Sunita T Pandey as the collaborator of the mentioned project. The project is being funded by Ministry of environment, forest, and climate change Govt. of India for National Mission of Himalayan Studies (NMHS). The summary of research results are described below:

Different concentrations of Herbal Kunapjal were tried to prime the chickpea seed under laboratory conditions to assess their effects on the quality of seed germination (in laboratory) and crop establishment in field. It was found that seed priming with 10% concentration of Herbal

Kunapjal for 8 hours resulted in the highest shoot length, root length, seedling length and seedling dry weight and seedling vigour index and also seed reserve mobilization efficiency. The results revealed that seed priming treatments significantly affected the physiological and biochemical parameters of seedling growth and seedling vigour of chickpea. Similar results were obtained in case of wheat seed, where 10% as well as 25% concentration of Herbal Kunapjal primed for seeds showed significantly higher seedling dry weight and seedling vigour index, which was at par with each other.

Potato crop has the capacity to grow from sea level to snowline, however, it is susceptible to a number of bio-stresses that hamper its production and cause significant economic losses. Different types of Herbal Kunapjal were tried against the black scurf disease of potato caused by *Rhizoctonia solani*, which is one of the most important disease known to reduce the quality, yield and price of the tubers in Tarai region. Of the five Vrikshayurveda-based liquid fermented organic formulations tested under laboratory (in vitro) conditions, Herbal Kunapjal (prepared with nettle + seasonal weeds) completely inhibited the *R. solani* mycelium growth at 10% concentration. This nettle and seasonal weeds-based Herbal Kunapjal also significantly reduced the disease incidence and disease index under field conditions over the untreated check. It was also observed that three different types of the herbal Kunapjal preparations evaluated fulfilled the nutrient requirements of the potato crop along with significantly decreasing the disease incidence and disease index compared with the untreated control. Interestingly, all the treatments of kunapjal despite zero fertilizer application were statistically at par in terms of germination per cent and tuber yield with the untreated check indicating that kunapjal fulfilled the nutrient requirement of the potato crop along with significantly decreasing the disease incidence and disease index compared to the untreated control. Thus Vrikshayurveda- based Kunapjal formulations evaluated under in vitro and in vivo conditions also showed promising results, which is considered effective in the longer run and thus can reduce the dependency on the use of chemicals.

The effect of various doses of Herbal Kunapjal on soil health, fresh biomass and oil yield of sweet basil (Tulsi) was assessed and found that the application of recommended dose of fertilizer on basil crop and application of 500 lit/ha Herbal Kunapjal at 15-20 days interval + 7.5 ton/ha FYM as basal dose were statistically at par in terms of fresh herbage and oil yield (271.86 q/ha and 143.33 kg/ha respectively). The highest total microbial population (34.1×10^4 CFU/g soil) was



obtained in the soil samples drawn from the plots treated with Herbal Kunapjal @ 500 lit/ha with 7.5 ton/ha FYM as compared to plots treated with the recommended dose of fertilizers (11.21×104 CFU/g soil). This may be the reason for the at par (equivalence) oil and herbage yield.

An important medicinal crop (*Metricaria chamomilla*) was treated with different types of Vrikshayurveda-based Herbal Kunapjal in different doses to see their effects on growth, flower yield and its essential oil quality of the crop.

Higher values of all vegetative parameters were obtained by higher doses of each type of Herbal Kunapjal. The Total Phenol Contents (TPC) and Total Flavonoids Contents (TFC) also showed dose dependent increases with the increasing dose of Herbal Kunapjal and were found maximum in 100% nettle grass- based Herbal Kunapjal. This in turn also increased the anti-oxidant potential of *M.*



chamomilla. With increasing dosages of Herbal Kunapjal, there was an increase in nutrient status of soil which contributed to the increased rate of photosynthesis in plant and to the activity of enzymes responsible for protein and starch synthesis, which are the precursors for synthesis of secondary metabolites. Application of all the three types of Herbal Kunapjal in *M. chamomilla* crop at all the doses resulted in significantly higher amount TPC & TFC contents over application of the recommended dose of chemical fertilizers. The high concentration of phenols and flavonoids in higher dosages of Herbal Kunapjala could be attributed to allocation of more carbon to the Shikimate pathway resulting in more hydrocarbon formation, which is the skeleton for phenols and flavonoids. Among different Herbal Kunapjals evaluated, the highest applied dose of nettle-based Kunapjal substantially increased the antioxidant activity of the chamomile plants, which might have occurred due to increased synthesis of secondary metabolites viz., phenols and flavonoids.

In case of gladiolus, which is an important commercial flower crop, the response of various kinds of Herbal Kunapjal was assessed in terms of flower yield, length of spike, florets per spike, and size of corms. The use of 10% concentration of integrated type of Herbal Kunapjal (nettle grass+local weeds) for seed treatment followed by its foliar spray at 10-15 day interval was found the best treatment for all the studied parameters of gladiolus crop. It was also found that the treatment with all three types of Herbal Kunapjal resulted in significantly higher bacterial, fungal and actinomycetes counts in soil in comparison to control (RDF). Thus the higher activity of beneficial microbes in the fermented organic fertilizers might have resulted in better nutrient uptake, photosynthesis and source-sink relationship. These



fermented organic fertilizers consisting of active phenolic compounds might have inhibited oxidase activity and promoted the persistence of IAA and GA3 (growth promoting substances) that might have increased the length of spike, increased number of florets per spike, and increased the size of corms.

Antifungal properties of various types of Kunapjal. Three different types of Herbal Kunapjal were tested in-vitro for their antifungal potential against four different pathogenic fungi causing significant diseases in various crops. These were *Alternaria solani*, causing early blight in tomato and other solanious crops, *Colletotrichum capsicii*, causing anthracnose in chilli, *Fusarium ciceris* causing chickpea wilt and *Helmenthosporium maydis*, causing leaf blight in maize. The pathogenic fungi were inoculated in the medium amended with fresh formulations of Herbal Kunapjal i.e. general, integrated and nettle-based formulations @1% concentration. The in-vitro results revealed that all the formulations were effective in reducing the mycelia growth of test fungi as compared with the control although the per cent inhibition of test fungi varied in three different Herbal Kunapjal formulations. The general formulation inhibited maximum mycelial growth of *C. capsicii* and *H. maydis*, however, minimum inhibition was recorded in *A. solani* and *F. ciceris*. Maximum growth inhibition was obtained in the integrated formulation for *A. solani*. Maximum growth inhibition for *F. ciceris* and *H. maydis* was recorded in nettle-based formulation. The fresh herbal concoctions when amended in the growth medium, encouraged the growth of bacteria and actinomycetes in the medium. These microbes might also be having their inhibitory effect on the tested pathogenic fungi. This is based on the observation that the in-vitro fungal growth inhibition was reduced and also the growth of bacteria and actinomycetes in the medium after the same concoctions were autoclaved at 121°C for 30 minutes by using saturated steam at 15 psi. From the results of various researches conducted, it can be concluded that the Vrikshayurveda-based Herbal Kunapjal concept, developed by late Dr. YL Nene, Founder Chairman of AAHF, can be used as a successful and sustainable alternative to the chemical fertilizers and other agro- chemicals being used for plant protection, increasing crop productivity and soil fertility, and also for increasing biodiversity and conserving the resources. In the initiation of the use of Herbal Kunapjal in the above research activities the suggestions, technical guidance and encouragement of Dr SPS Beniwal, the present Chairman of AAHF is greatly appreciated.

Thesis Research on Kunapjal at GBPUA&T, Pantnagar

A number of Masters' thesis that have been submitted at GBPUA&T, Pantnagar on the topic of Herbal Kunapjal are given below. We must appreciate the faculty in the College of Agriculture for initiating this research through their graduate students.

Thesis already submitted. The following thesis for Masters' degree have been already submitted since 2019.

1. Rahul Yadav (Id. No. 54175). 2019. M.Sc. (Ag.), Agronomy.
Thesis title: "Effect of Fermented Organic Liquid Manures on Soil Health, Fresh Biomass and Oil Yield of Sweet Basil (*Ocimum basilicum* L.)"

2. Ankita Kalpasi (Id. No. 55354). 2020. M.Sc. Biological Sciences

Thesis title: "Effect of Vrikshayurveda-based Herbal Kunapjala (Liquid biofertilizer) on Growth, Flower Yield and Essential Oil Quality of *Matricaria chamomilla* L."

3. Okram Ricky Devi (Id. No. 55435). 2020. M.Sc. (Ag.) Agronomy

Thesis title: "Response of late sown wheat (*Triticum aestivum* L.) to seed treatment and foliar application of herbal kunapjala under different dose of nutrients"

4. Rahul Halder (Id. No. 55415). 2020. M.Sc. (Ag.) Agronomy

Thesis Title: "Response of chickpea (*Cicer arietinum* L.) to seed treatment and foliar application of vrikshayurveda based herbal kunapjala under different dose of nutrients.

5. Suraj Adhikari (Id. No. 48310). 2020. M.Sc. (Ag) Plant Pathology

Thesis Title: "Eco friendly management of black scurf of potato caused by *Rhizoctonia solani* Kuhn"

6. Shreekant (Id. No. 55464). 2020. M.Sc. (Ag) Horticulture

Thesis Title: "Response of herbal kunapjala, an organic fermented fertilizer on vegetative, flowering and corm attributes of gladiolus cv. Jessica under Tarai region of Uttarakhand'.

Thesis in progress on Herbal Kunapjal (Titles yet to be finalized). The following M. Sc./Ph.D. thesis are in progress.

Mr. Banawat Mahesh (Ph.D)	Agronomy	Mustard crop
Ms. Suchsmita (M.Sc.)	Horticulture	Litchi
Mr. Rahul Purohit (Ph.D)	Plant Pathology	Mustard Crop
Mr. Sunil Dutt Pant (Ph.D)	Entomology	Mango crop
Mr. Mrigesh Bhatt (M.Sc)	Entomology	Chickpea

Following thesis are at planning phase to work on Herbal Kunapjal.

On Jack fruit (M.Sc)	-	Horticulture
On Cowpea (Lobia) (Ph..D)	-	Plant Pathology

Visit of Dr Rajeev Kumar, Vice-Chairman of Niti Ayog to GBPUAT

Dr Rajeev Kumar, the Vice-Chairman of Niti Ayog of Government of India, visited GBPUA&T, Pantnagar on 9 June 2021. During his visit, Dr Sunita T Pandey, Professor Agronomy & Executive Secretary AAHF, presented a set of publications of AAHF to Dr Rajeev Kumar. These publications were unearthed, collected, translated and published into English (and also most in Hindi) by AAHF through the untiring efforts of Late Dr YL

Nene, the Founder Chairman of AAHF starting from 1994 till January 2018. Among these publications which included eight Classical Bulletins, two, especially Krishi- Parashar by Parashar, (2400 BCE) and Vrikshayurveda by Surapala (c. 1000 CE), have tremendous relevance to the present-day agriculture, natural farming and organic farming.

Dr Rajeev Kumar also unveiled the statue of Sage Parashar installed in the front lawn of the College of Agriculture. The statue was graciously donated by Dr. Sunita T Pandey, Professor Agronomy, college of Agriculture & Executive Secretary, AAHF, GBPUAT, Pantnagar.

Celebration of the 85th Birthday of Late Dr YL Nene

The 85th birthday of Late Dr YL Nene, Founder Chairman of AAHF, was celebrated in online mode on 24th November 2021.

Dr YL Nene memorial lecture on the occasion was delivered by Dr SPS Beniwal, Chairman, AAHF, on "Potential and Relevance of Vrikshayurveda in Sustainable Agriculture including Organic Cultivation in India". The Memorial lecture was followed by release of following two Hindi translation publications of AAHF: (i) Krishi Gita (Agri-History Bulletin No. 7), and (ii) Organic Tea (Agri-History Report - 1). The function was chaired by Dr AK Shukla, Acting Vice-Chancellor, GBPUA&T, Pantnagar. Many academicians, scholars, farmers and policy makers participated in the on-line function.



Attention

Please send your contributions to the Newsletter to

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