

Vrikshayurveda based Natural farming Research at Pantnagar

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

A.Crops related research. The research work on Vrikshayurved based natural farming 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 Kunap jal, the AAHF modified version of original Kunap jal 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 collaborative research programm “Exploring the possibilities of Introduction and integration of nettle-based liquid fermented organic Vrikshayurveda concoctions on various selected crops of district Almora”,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,Professor,department of agronomy, college of agriculture, GBPUAT, Pantnagar, as the collaborator of the mentioned project with the team of multispecialty team of scientists. 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 Kunap jal 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 Kunap jal 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 Kunap jal 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 Kunap jal 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 Kunap jal (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 kunap jal despite zero fertilizer application were statistically at par in terms of germination per cent and tuber yield with the untreated check indicating that Kunap jal 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 Kunap jal 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 Kunap jal 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 (271.86q/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 (11.21×10^4 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 Kunap jal 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 Kunap jal, 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 Kunap jal 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 Kunap jala 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 Kunap jal 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 Kunap jal (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 Kunap jal 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.

B.Antifungal properties of various types of Kunapjal : Three different types of Herbal Kunap jal 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 Kunap jal 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 Kunap jal 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 Kunap jal in the above research activities the suggestions, technical guidance and encouragement of Dr SPS Beniwal, the present Chairman of AAHF is greatly appreciated.

C.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 Kunap jal 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 has 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'.