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EFFECT OF LIQUID FERMENTED ORGANIC MANURE CONCOCTIONS AND THEIR FOLIAR SPRAY UNDER DIFFERENT DOSE OF NUTRIENTS ON CHLOROPHYLL CONTENT OF LATE SOWN WHEAT

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ABSTRACT

Farmers today mostly rely on outside inputs for their farming operations, which seriously harms the environment. Using locally available resources, this subject led the current inquiry to concentrate on old (or traditional) methods that improve agricultural growth and development without harming the environment. The design used for experimentation was randomized block design (RBD). T_1: No seed priming + 100% RDN, T_2: Hydropriming + 100% RDN, T_3: 10% kunapajala priming + 100% RDN + foliar application of 10% herbal kunapajala, T_4: 10% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala, T_5: 10% kunapajala priming + 50% RDN+ foliar application of 10% herbal kunapajala, T_6: 10% kunapajala priming + no Fertilizer + foliar application of 10% herbal kunapajala, T_7: 25% kunapajala priming + 100% RDN+ foliar application of 10% herbal kunapajala, T_8: 25% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala, T_9: 25% kunapajala priming + 50% RDN+ foliar application of 10% herbal kunapajala, T_{10}: 25% kunapajala priming + no fertilizer+ foliar application of 10% herbal kunapajala, T_{11}: 50% kunapajala priming + 100% RDN+ foliar application of 10% herbal kunapajala, T_{12}: 50% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala, T_{13}: 50% kunapajala priming + 50% RDN + foliar application of 10% herbal kunapajala and T_{14}: 50% kunapajala priming + no fertilizer+ foliar application of 10% herbal kunapajala. The higher chlorophyll a content was observed in T_7, T_2, T_3 and T1 (14.47, 14.17, 14.17 and 12.57 mg/g DW, respectively) as compared to other treatments but was at par with each other.

Key words : Herbal kunapajala, Agriculture, Vrikshayurveda, Seed priming.

Introduction

The primary staple crop grown by people in North India and around the world is wheat. It makes up a substantial portion of global food security. 30.8 Mha of wheat with an average yield of 3.2 t ha^{-1} produced 98.5 Mt of wheat in India. With a 14.0% area contribution and a 13.6% output share, India is the world's second-largest producer of wheat (Anonymous, 2018). India contributes significantly to both the world's wheat area and total production, although its productivity is only slightly greater than that of the rest of the world (3.17 t ha^{-1} vs. 3.12 t ha^{-1}). There is a reduction in arable land as population grows. As a result, the primary goal would be to raise productivity through the use of better farming techniques. The issue of natural resource depletion that Indian agriculture is currently confronting stems from the ongoing usage of synthetic fertilizers, especially since the green revolution. The goal of the green revolution was to increase crop yield only in order to meet the population's self-sufficient food needs. As a result, farmers began to widely use fertilizer procedures with inadvertently incorrect application rates. Furthermore, the past forty years have seen an increase in the use of synthetic fertilizer due to the 1977 fertilizer subsidy system. The output of food grains increased as a result, albeit at the expense of the depletion of natural resources. The farming community is therefore compelled by extreme necessity to concentrate on both the sustainable maximization of crop output and the preservation of natural resources. In this situation, organic manure which naturally possesses the ability to improve soil health and provide vital micro- and macronutrients for a timely and balanced contribution to plant growth and development will be indispensable.

More information about herbal kunapajala, a fermented liquid organic manure, may be found in the Vrikshayurveda, penned by Surapala circa 1000 AD and in Lokopakara, penned by Chavundaraya circa 1025 AD (Chakraborty *et al*., 2019). Herbal kunapajala is a highly effective alternative nutrient source for crop growth and development when compared to chemical fertilizers. Using herbal kunapajala as a nutrient supplement can be applied to crop plants at any stage of growth. The breakdown of complex components into lower molecular weight molecules during ingredient fermentation accounts for the efficiency of herbal kunapajala, releasing nutrients for plant uptake (Neff *et al*., 2003).

Seed priming is a process of regulating the germination process by managing the temperature and seed moisture content and is the most widely used seed invigoration technique to improve field emergence and crop establishment under adverse environmental condition (Devi *et al*., 2023b). Crop establishment is an important factor depends upon optimum plant population and uniform emergence. Proper crop establishment depends upon quality of the seed in terms of its germination and seedling vigour. Seed priming is the most widely used seed invigoration technique to improve field emergence and crop establishment under adverse environment condition (Devi *et al*., 2022). This pre-sowing seed treatment involves soaking the seeds in priming media until they reach the second phase of germination, which varies depending on the crop, and then drying them in the shade. Synchronized crop growth and uniform emergence could be enhanced by this approach. It can boost field emergence and have the capacity to increase seedling vigor and fresh seed germination. It can also effectively rejuvenate partially aged seeds.

According to Sreenivasa *et al*. (2010) liquid organic manure is crucial for improving the vigor, quality, and immunity of plant systems. Herbal kunapajala improves soil fertility and has a higher concentration of macro and micronutrients. Because of the increased availability of minerals in the soil, particularly nitrogen and magnesium, plants can absorb them more readily. The main structural nutrients in chlorophyll content are nitrogen and magnesium, which are formed by the porphyrin ring. On the other hand, a high chlorophyll content promotes assimilate production and photosynthetic activity in plants. Due to increase in chlorophyll content per unit area, enhances in assimilates production and ultimately increase in dry matter. Additionally, it also supplies growth promoting hormones *viz*., IAA and GA_3 (Palekar, 2006; Natarajan, 2007; Sreenivasa *et al*., 2010). The aim of the study is to observe the best management practices under of different treatments on chlorophyll content of late sown wheat crop.

Materials and Methods

At the Norman E. Borlaug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Udham Singh Nagar, Uttarakhand, India (Fig. 1), a field experiment was carried out during the 2020–21 *rabi* season. The experimental plot is situated 243.83 meters above mean sea level (MSL) in latitude 290 01' N and longitude 790 48' E. During the experimentation, average weekly maximum temperature varied from 16.6 °C-37.5°C with an average of 27.1°C, while the minimum temperature fluctuated from 6.1°C-17.8°C with an average of 11.9°C. Maximum relative humidity was 83% with fluctuation of 52% to 97% whereas minimum relative humidity was 43%. The total amount of rainfall received during crop period was 42.5 mm with 4 rainy days. Three replications of the experiment were conducted using a randomized block design (RBD) (Rangaswamy, 1995). Wheat variety UP-2526 was sown on 28th December, 2020 with a seed rate of 125 kg/ha at 5 cm deep and row-to-row distance of 20 cm using seed drill and harvested on 23rd April, 2021. The study comprised of 14 treatments as follows:

T_1: No seed priming + 100% RDN

T_2: Hydropriming + 100% RDN

T_3: 10% kunapajala priming + 100% RDN+ foliar application of 10% herbal kunapajala

T_4: 10% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala

T_5: 10% kunapajala priming + 50% RDN+ foliar application of 10% herbal kunapajala

T_6: 10% kunapajala priming + no Fertilizer+ foliar application of 10% herbal kunapajala

T_7: 25% kunapajala priming + 100% RDN+ foliar application of 10% herbal kunapajala

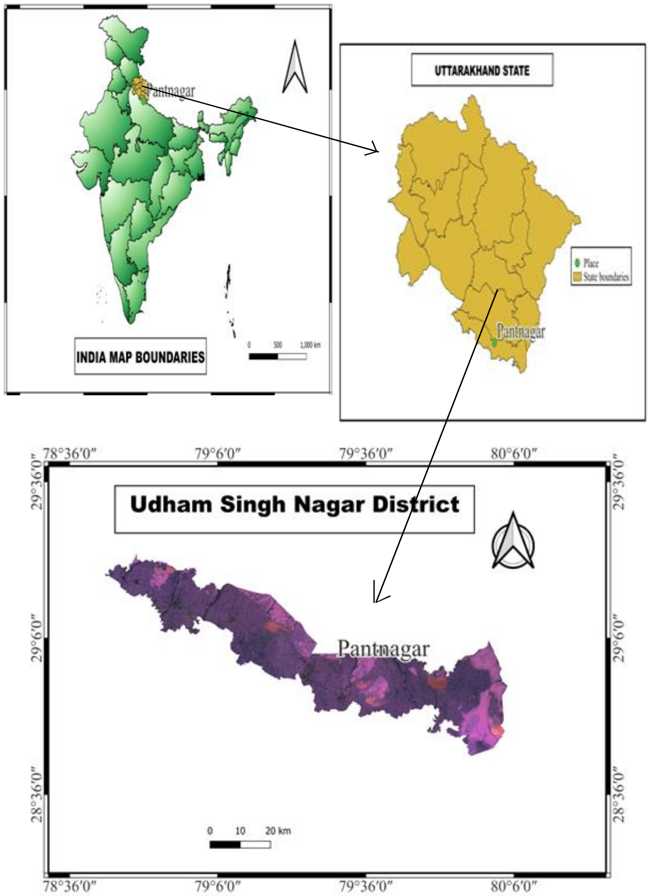

Fig. 1 : Map of the experimental area, Udham Singh Nagar, Uttarakhand, India.

T_8: 25% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala

T_9: 25% kunapajala priming + 50% RDN+ foliar application of 10% herbal kunapajala

T_{10}: 25% kunapajala priming + no fertilizer+ foliar application of 10% herbal kunapajala

T_{11}: 50% kunapajala priming + 100% RDN+ foliar application of 10% herbal kunapajala

T_{12}: 50% kunapajala priming + 75% RDN+ foliar application of 10% herbal kunapajala

T_{13}: 50% kunapajala priming + 50% RDN+ foliar application of 10% herbal kunapajala

T_{14}: 50% kunapajala priming + no fertilizer+ foliar application of 10% herbal kunapajala

#RDN : Recommended dose of nutrients

Foliar application of 10% herbal kunapajala was done at 25, 45, 65, 85 and 105 DAS except T_1 and T_2. The recommended dose of nutrients (RDN) were 120-60-30 kg/ha N-P_2O_5-K_2O. The seeds were treated with different concentration of herbal kunapajala *viz*, 10%, 25% and 50% and hydropriming (tap water) for 16 hours in the ratio of 1:2 (seed: priming media) (w/v) followed by shade drying to reach initial moisture content (11.6% as measured). To create a fine seed bed for optimal seed germination, a tractor-mounted disc harrow and rotavator were used for the tillage operation. The field was then leveled using pata. Small bund makers were used to create the bunds around the edges and human-made bunds are created in between the plots.

Preparation of herbal kunapajala

A 200-liter plastic drum was filled with 20 kilograms of cow dung and 20 litres of cow urine to make the herbal kunapajala. Put two kilograms of sprouted urd, two kilograms of mustard cake, and two kilograms of crushed jaggery into a plastic barrel. 20 liters of water were then added to ensure that the ingredients were properly mixed. After being weighed and chopped into small bits, 20 kg of fresh nettle plants were added to the drum. Two days before to the manufacture of the herbal kunapajala, paddy husk was cooked in water for 15 to 20 minutes and the contents were strained. The drum was filled with the filtered contents. The drum was filled with one liter of each of the milk and butter milk. Water was added up to the lid's opening after all the ingredients had been added and stirred once with a wooden stick. When everything was ready, the lid was shut. Using a wooden stick, stir things for ten minutes every morning and evening. We can see the bubbles on top of the solution once the fermentation process begins. The herbal kunapajala is ready for field application when the bubbles cease appearing after 20 to 25 days. Herbal kunapajala solution was preserved for later usage after the mixture was filtered through mesh to get rid of any leftover residue.

The method and ingredients for preparing general herbal kunapajala were the same as those for nettle-based herbal kunapajala preparation, with the exception of adding nettle leaves. We used 2 kg of freshly chopped leaves and plants of general weeds, such as neem (*Azadirachta indica*), wild jasmine (*Clerodendrum* sps.), beal (*Aegle marmelos*), datura (*Datura* sps.), lantana (*Lantana camara*), mango (*Mangifera indica*), guava (*Psidium guajava*), calotropis (*Calotropis* sps.), castor (*Ricinus commumis*) and billy goat weed (*Ageratum conyzoides*), in that order. On the other hand, half the amount of nettle plants and common weeds was combined to make integrated herbal kunapajala, with the remaining steps being the same. The dosages of the herbal kunapajala were administered in accordance with the treatment plan and under monitoring.

Chlorophyll content determination

Following chlorophyll extraction with 80% acetone, the chlorophyll concentration in leaves and homogenates was measured using spectrophotometry (Vernon, 1960). The outcomes were stated in terms of one gram of dry leaf matter.

Statistical analysis

Analysis of the data gathered from different observations was done as per the analysis of variance (ANOVA) technique for simple randomized block design using standard procedure given by Gomez and Gomez (1984). The critical difference was calculated at 5% level of significance.

Results and Discussion

Table 1 shows the chlorophyll content as affected by various treatments at different stages of crop growth.

Among the treatments, significant difference was noticed in chlorophyll content. The higher chlorophyll a content was observed in T_7, T_2, T_3 and T_1 (14.47, 14.17, 14.17 and 12.57 mg/g dry wt, respectively) as compared to other treatments but was at par with each other. While the lowest value was observed from T_{14}, T_6 and T_{10} (9.43, 9.93 and 10.40, mg/g dry wt, respectively).

Chlorophyll b content was found higher in T_7, T_2, T_3 and T_1 (4.50, 4.50, 14.46 and 4.43 mg/g dry wt., respectively) but it was shown significantly at par with rest of the treatments except T_{14}, T_6 and T_{10} (3.66, 3.53 and 3.55, mg/g dry wt, respectively) which showed lowest value among the treatments.

Similar trends of chlorophyll (a+b) and chlorophyll (a/b) were followed as in case of above parameters as depicted by Fig. 2.

A useful indicator of photosynthetic activity, stress, and plant health is the amount of chlorophyll present. Four nitrogen atoms are bonded in each chlorophyll structure, which is a component of the nitrogen content in leaves. The increased levels of total chlorophyll, carotenoid and chlorophyll a and b in mustard plants may be attributed to the higher nitrogen content of nettle-based herbal kunapajala. The herbal kunapajala made of nettles was smeared both topically and bottomally, perhaps increasing the plant-available nutrients.

Herbal kunapajala applied topically is directly absorbed by the leaf via the stomatal aperture. The amount of chlorophyll per unit leaf area is also significantly influenced by leaf area. When comparing kunapajala treatment to conventional farming and organic farming (9:1 ratio of soil to vermicompost mixture), Deshmukh *et al*. (2012) saw a rise in the number of leaves per plant. Furthermore, compared to other treatments, the kunapajala treatment showed the highest levels of leaf

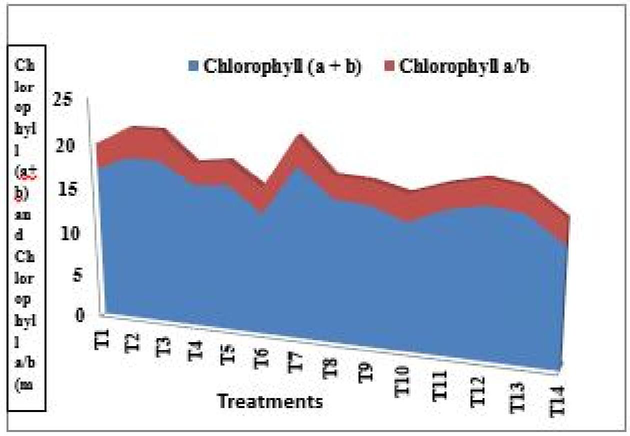

Fig. 2 : Chlorophyll (a+b) and chlorophyll a/b as affected by different treatments.

Table 1 : Content of chlorophylls a and b in leaves of wheat.

Treatments	Chlorophyll *a* (mg/g DW)	Chlorophyll *b* (mg/g DW)
T_1	12.57	4.43
T_2	14.17	4.46
T_3	14.17	4.50
T_4	11.43	4.19
T_5	11.87	4.42
T_6	9.93	3.53
T_7	14.47	4.50
T_8	11.27	4.35
T_9	11.03	4.29
T_{10}	10.40	3.55
T_{11}	11.30	4.30
T_{12}	11.97	4.41
T_{13}	11.40	4.48
T_{14}	9.43	3.66
SE(±m)	0.52	0.18
C.D.	1.53	0.51

area index, total chlorophyll, carotenoids, and xanthophylls. Similar to this, applying 3% panchagavya spray above control and various panchagavya concentrations resulted in greater pigment content (chl a and chl b) in tomato crops during the seedling, blooming, and yielding stages (Rakesh *et al.*, 2017). Somasundaram *et al*. (2007) showed that plants sprayed with panchagavya had larger leaves and a denser canopy. Comparable results were noted for *Vigna radiate*, *Vigna mungo* and *Oryza sativa* (Tharmaraj, 2011) as well as *Arachis hypogaea* (Subramaniyan, 2005). Treatments under 10% herbal kunapajala seed priming and their foliar spray under 100% RDN reported the highest levels of chlorophyll across all metrics. This could be the result of applying aoptimum dosage of herbal kunapajala, which has a higher concentration of macro- and micronutrients that are accessible in plants, particularly nitrogen content. Herbal based kunapajala is used as nourishment of seed, crop and soil. It is very effective in nourishing plants at various stages and can be used as a seed priming technique (Devi *et al*., 2023b). Another finding reported that Seed priming with either 10% or 25% herbal based kunapajala was found to be an eco-friendly technique that improve emergence, seedling development and biochemical activity of wheat over hydropriming and no priming (Devi *et al*., 2022). Herbal kunapajala treatments noticed better pigment content. Further, application of liquid fermented organic manures make easily available nutrient to plant. In control leaves, chlorophyllase was activated in parallel with the decrease in chlorophyl content, which might result partly from enzyme inactivation in the light stage of chlorophyll biosynthesis.

Conclusion

On the basis of experimentation, nettle based herbal kunapajala gave higher chlorophyll content values. It may be concluded that seed invigoration with either 10% or 25% herbal based kunapajala long with its foliar spray under optimum nutrient doses may be an eco-friendly technique that can be used to improve chlorophyll contents of wheat seeds.

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Conflict of interests

The authors have stated that there are no conflicting interests.

References

Anonymous (2018). Agricultural statistics at a glance, directorate of economics and statistics, MoA and FW, Government of India, New Delhi; 2018.

Chakraborty, B., Sarkar I., Maitra S., Khan A.M., Bandyopadhyay S. and Sinha A.K. (2019). Nutritional and microbial analytical study of Vedic liquid organic manure cum pesticide kunapajala with different storage time interval. *Int. J. Pharmac*., **6(6)**, 209-215.

Devi, O.R., Verma O., Halder R., Pandey S.T. and Chaturvedi P. (2022). Effect of Seed Priming with Liquid Organic on Germination, Seedling Development and Enzymatic activity of wheat (*Triticum aestivum* L.). *Environ. Ecol.*, **40(3C)**, 1720-1725.

Devi, O.R., Verma O., Laishram B., Raj A., Singh S. and Gaurav K. (2023a). Influence of Seed Invigoration with Organic Kunapajala on Seed Quality and Biochemical activity in Late Sown Wheat. *Int. J. Environ. Clim. Change*, **13(9)**, 900-906.

Devi, O.R., Verma O., Pandey S.T., Laishram B., Bhatnagar A. and Chaturvedi P. (2023b). Correlation of germination, seedling vigour indices and enzyme activities in response to liquid organic Kunapajala to predict field emergence in late sown wheat.

Gomez, K.A. and Gomez A.A. (1984). *Statistical procedure for agricultural research*. 2nd Edn. John Wiley and Sons, New York, ,1984, 241–271.

Hiscox, J.D. and Israelstam G.F. (1979). A method for extraction of chlorophyll from leaf tissue without maceration. *Canadian J. Bot.*, **57**, 1332-1334.

Natarajan, K. (2007). Panchagavya for plant. *Proc. Nation. Conf. Glory Gomatha*, S. V. Veterinary Univ., Tirupati, 72-75 p.

Neff, J.C., Chaplin III F.S. and Vitousek P.M. (2003). Breaks in the cycle: Dissolved organic nitrogen in terrestrial ecosystems. *Front. Ecol. Environ.* **1**, 205-211.

Palekar, S. Shoonya Bandovalada, Naisargika Krushi, published by Swamy Anand, Agri Prakashana, Bangalore, India. 189 p.

Rangaswamy, R.A. (1995). Textbook of Agricultural Statistics. New Age International (P) Limited Publishers, New Delhi, 358 p.

Sreenivasa, M.N., Nagaraj Naik M. and Bhat S.N. (2020). Beejamruth: A source for beneficial bacteria. *Karnataka J. Agric. Sci.*, **17(3)**, 72-77.

Vernon, L.P. (1960). Spectrophotometric Determination of Chlorophylls and Pheophytins in Plant Extracts. *Anal. Chem.*, **32**, 1144–1150.