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Impact of Foliar Nutrition Sprays and Hydrogel on Lentil Yield and Profitability in Sangrur, Punjab Region

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ABSTRACT

Two winter (rabi) seasons in a row (2022–23 & 2023-24) saw the Department of Agriculture at Bhai Gurdas Degree College in Sangrur, Punjab, India, execute a field experiment. Three hydrogel levels—2.5, 5.0, and 0 kg/ha—were maintained in the main plots of the experiment, while five foliar nutrition levels—water spray, 2% urea, thiourea 500 ppm, salicylic acid 75 ppm, and NPK (19:19:19) @ 0.5 percent—were maintained in the subplots. Before planting lentils in designated strips, hydrogel was drilled 7–8 cm deep into the ground. Foliar nutrition was then sprayed on the plants at crucial times, such as during the commencement of the bloom and the development of the pod. The maximum B: C ratio (1.41) was obtained with hydrogel 2.5 kg/ha being on par with hydrogel 5.0 kg/ha over no hydrogel. The results showed that drilling of hydrogel 5.0 kg/ha before sowing recorded significantly higher pods/plant (66.5), grain yield (1210 kg/ha), and net return (Rs. 27507/ha) over control and 2.5 kg/ha, respectively. Foliar treatment of NPK (19:19:19) @ 0.5% during the stages of pod development and flower initiation resulted in significantly greater grain output (1127 kg/ha), net return (Rs. 26646/ha), and pods/plant (63.2) than water spray and urea 2%, respectively.

Keywords: *salicylic acid, urea, hydrogel, productivity, and foliar nutrition.*

INTRODUCTION

One of the most significant pulse crops grown in Punjab and other parts of India is lentil (*Lens culinaris* Medik.). Lentils, well-known for their nutritional benefits, are an important part of the Indian diet since they offer a substantial source of dietary fiber, protein, and important minerals. However, issues like inadequate soil fertility, lack of water, and unpredictable weather patterns frequently limit the output of lentil farming in Punjab's Sangrur region. Innovative agronomic techniques must be implemented in order to address these issues and increase crop yield and profitability. Due to its semi-arid climate, the Sangrur region frequently has water shortages, which can negatively affect the development and productivity of lentil crops. Conventional irrigation techniques frequently fall short of the crop's water needs, particularly at crucial growth stages.

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Furthermore, it's possible that the region's soils don't always supply enough nutrients, which can result in nutrient deficiencies and further reduce agricultural yield. Hydrogels and foliar nutrition sprays have become a potential approach to solve these problems (Lentz et al., 1998). Superabsorbent polymers that can hold and release water for long periods of time are called hydrogels. Hydrogels have the potential to greatly increase soil moisture retention, decrease evaporation losses, and improve plant water availability when added to the soil. This is especially helpful in areas like Sangrur, where a significant issue is water scarcity. Hydrogels can lessen the impacts of water stress, encourage better root development, and eventually increase crop yields by keeping the root zone at a more constant moisture level. Lewis & Gehring, 1980). Foliar nutrition sprays provide an additional means of increasing lentil productivity in addition to hydrogels. With foliar sprays, nutrients are applied directly to the leaves of the plant, facilitating rapid uptake and use. When it comes to treating vitamin deficits that may occur during crucial growth phases, this strategy works particularly well. Through foliar spraying with key nutrients like potassium, phosphorus, nitrogen, and micronutrients, farmers can boost the physiological processes of lentil plants, which will improve photosynthesis, better form pods, and yield more grain.

The Sangrur region's water scarcity and nutrient inadequacies can be overcome by a synergistic method that combines the use of hydrogels and foliar nutrition sprays. This integrated approach has the potential to increase overall lentil farming profitability in addition to increasing productivity. Therefore, it is essential to comprehend the precise impacts of these treatments in the agroclimatic conditions of Sangrur in order to maximize lentil production in this area.

MATERIALS AND METHODS

Two winter (rabi) seasons in a row (2022–23 & 2023-24) saw the Department of Agriculture at Bhai Gurdas Degree College in Sangrur, Punjab, India, execute a field experiment. Three hydrogel levels—0.0, 2.5, and 5.0 kg/ha—were maintained in the main plots of the experiment, while five levels of foliar nutrition—water spray, 2% urea, thiourea 500 ppm, salicylic acid 75 ppm, and NPK (19:19:19) @ 0.5 percent—were maintained in the subplots. Split plot design was used to set up the experiment, which was repeated three times. Prior to the sowing of lentils in designated strips, hydrogel was drilled into the soil. At key points, such as the commencement of flowers and the development of pods, foliar nutrition was then sprayed. At the time of planting, seeds were treated with rhizobium and phosphate solubilizing bacteria (PSB) at a rate of 10 g/kg. The recommended dosage of fertilizer (20 kg N, 17.5 kg P, 16 kg K/ha, 20 kg S, and 5 kg Zn) was also drilled into the soil. For experimental purposes, the lentil variety "IPL 316" was sown on November 26, 2020, and November 16, 2021, at 30 cm and 5 cm inter- and intra-row spacing, respectively, using the indicated seed rate of 60 kg/ha. Pendimethalin 30 EC @ 1.0 kg/ha was used as a preemergence herbicide to control weeds, and hand weeding was done 35–40 days following seeding. When necessary, the plant protection measures were implemented. Five plants were chosen at random from each plot and tagged in order to collect biometric data on the characteristics of yield and growth.

RESULTS AND DISCUSSION

Growth and yield characteristics

In comparison to no hydrogel drilling in the soil, the results demonstrated that hydrogel drilling had a favorable impact on plant growth and yield qualities (Table 1). Prior to seeding, hydrogel was drilled at a rate of 5.0 kg/ha, which resulted in the tallest plant (60.1 cm) and the greatest number of branches (2.0), pods (66.5) and grains/pod (1.5) per plant, respectively, compared to the control and 2.5 kg/ha. It was seen to be 15.4, 42.9, 33.5, and 7.1% greater than the control, in that order. This could be because hydrogel saves water, creating a buffered environment that reduces losses during the early stages of the lentil plant's development and is beneficial under short-term drought tension. Therefore, highly absorbent polymers, or hydrogel, increase plant growth by allowing soils to hold more water (Boatright et al., 1997) and by postponing the time until withering under drought stress (Gehring & Lewis, 1980).

Table1. Impact of foliar nutrition and hydrogel on lentil growth and yield characteristics (Pooled data of 2 years)

Treatment	Plant height (cm)	Branches /plant	Pods/plant	Seeds/pod	Test weight (g)
Hydrogel (kg/ha)					
0	52.1	1.4	49.8	1.4	25.8
2.5	56.2	1.8	59.1	1.5	26.1
5.0	60.1	2.0	66.5	1.5	26.2
SEm±	**0.98**	**0.03**	**1.48**	**0.05**	**0.60**
CD (P=0.05)	**3.19**	**0.10**	**4.83**	**0.17**	**NS**
Foliar nutrition spray (FI & PD)					
Water spray	51.7	1.5	52.6	1.3	25.7
Urea 2 %	53.7	1.7	56.7	1.4	25.9
Thiourea 500 ppm	56.7	1.7	59.1	1.5	26.0
Salicylic acid 75 ppm	58.2	1.8	59.7	1.5	25.2
NPK (19:19:19) 0.5 %	59.4	1.9	63.2	1.5	26.4
SEm±	**0.83**	**0.08**	**1.31**	**0.06**	**0.42**
CD (P=0.05)	**2.43**	**0.22**	**3.75**	**0.18**	**NS**

Consequently, the application of super absorbent has caused plants to respond positively in terms of dry matter production and complete proficiency in water consumption. Similar to this, the application of SAPs enhanced the physical characteristics of the soil, increased water holding capacity, decreased evaporation losses, decreased infiltration rate, and reduced the rate of soil deterioration (Shooshtarian et al., 2012). These improvements eventually improved growth and yield attributes, increasing lentil grain yield in conditions of water scarcity.

The growth metrics and production features of lentils were positively impacted by foliar application of nutrients during the stages of pod development and blossom commencement. The pooled data also showed that the tallest plant (59.4 cm), the highest number of branches/plant (1.9), the number of pods/plant (63.2), and the number of grains/pod (1.5) were significantly increased by foliar application of NPK (19:19:19) @ 0.5% during the flower initiation and pod development stages. These results were comparable to salicylic acid 75 ppm over water spray, urea 2%, and thiourea 500 ppm, respectively. The percentage increase in terms of plant height, branches/plant, pods/plant, and seeds/pod over water spray is 14.8, 26.7, 20.1, and 15.4. A foliar application of NPK 19:19:19 @ 0.5%, 75 ppm salicylic acid, and 500 ppm thiourea may aid with this. Enhanced dark fixation of CO2 in plant embryonic tissues has a variety of biological functions. Thiourea contains cytokinin-like action, which is very useful in delaying senescence, hence its favorable effect may be attributable to delayed senescence of both vegetative and reproductive organs (Halmann, 1980). During the cereal grain filling cycle, these regulators are also known to increase the photosynthetically active leaf surface (Sahu et al., 1993). Hydrogel drilling and foliar spraying bioregulators (salicylic acid, urea, and multigrade nutrients) had no discernible effects on test weight compared to control.

Yield

The maximum grain yield (1210 kg/ha) and net return (Rs. 27,507/ha) over control and 2.5 kg/ha, respectively, were recorded with the application of hydrogel at 5.0 kg/ha (Table 2). It was seen to be 43.7 and 54.9% greater than the control, respectively. On the other hand, hydrogel 2.5 kg/ha produced a maximum and noticeably higher B: C ratio (1.41) compared to hydrogel 5.0 kg/ha above no hydrogel.

Table2. Impact of foliar nutrition and hydrogel on lentil production and economics (pooled data of 2 years)

Treatment	Grain yield (kg/ha)	Harvest Index (%)	Net return (Rs/ha)	B: C ratio
Hydrogel (kg/ha)				
0	842	30.27	17757	1.12
2.5	1105	30.47	25805	1.41
5.0	1210	30.82	27507	1.32
SEm±	20.7	0.15	870	0.04
CD (P=0.05)	71.7	NS	2795	0.12
Foliar nutrition spray (FI & PD)				
Water spray	951	30.31	19775	1.08
Urea 2 %	1024	30.33	22746	1.23
Thiourea 500 ppm	1056	30.60	24358	1.33
Salicylic acid 75 ppm	1090	30.58	24922	1.33
NPK (19:19:19) 0.5 %	1127	30.60	26646	1.44
SEm±	17.0	0.21	723	0.03
CD (P=0.05)	50.2	NS	2029	0.10

The use of hydrogel, a super absorbent polymer, may be the cause. Hydrogel increases soil's capacity to hold water, which promotes plant growth (Boatright et al., 1997) and delays the time plants take to wilt under drought stress (Gehring & Lewis, 1980). These actions ultimately improve growth and yield attributes, leading to a higher harvest of lentil grains.

The foliar application of nutrients during the stages of pod development and flower initiation had a positive impact on lentil grain production and economics. The combined data also showed that the maximum and significantly higher grain yield (1127 kg/ha), net return (Rs. 26646/ha), and B:C ratio (1.44) were obtained by foliar application of NPK (19:19:19) @ 0.5% during the flower initiation and pod development stages. This was also comparable to salicylic acid 75 ppm over water spray, urea 2%, and thiourea 500 ppm, respectively. The percentage increase in grain production over water spray was 18.5, 9.7, and 5.7, respectively, with urea at 2% and thiourea at 500 ppm. This might be a spray of urea 2% and NPK 19:19:18 @ 0.5%. According to Palta et al. (2005), enhanced nitrogen supply to leaves through foliar absorption may have prevented leaf senescence and enabled higher soil total assimilation and carbon remobilization to the seeds of more pods.

CONCLUSION

According to two years of research, the most effective ways to increase lentil grain production and economics are to drill hydrogel 2.5–5.0 kg/ha prior to lentil sowing and then foliar spray either NPK (19:19:19) @ 0.5% or salicylic acid 75 ppm during flower initiation and pod development. Hydrogel may therefore prove to be a realistically useful, financially possible, and viable solution in water-stressed areas for raising agricultural output while maintaining environmental sustainability, when combined with foliar application of either NPK 19:19:19 or salicylic acid 75 ppm.

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There is no such evidence of conflict of interest.

Author Contribution
All authors have participated in critically revising of the entire manuscript and approval of the final manuscript.

REFERENCES

Boatright, J. L., Balint, D. E., Mackay, W. A., & Zajicek, J. M. (1997). Incorporation of a hydrophilic polymer into annual landscape beds. *Journal of Environmental Horticulture 15*, 37-40.

Choudhary, M. L., Shalaby, A. A., & Al-Omran A. M. (1995). Water holding affected soils as capacity and evaporation of calcareous by four synthetic polymers. *Communication in Soil Science and Plant Analysis 26*, 2205-2215.

Davies, S. L., Turner, N. C., Palta, J. A., Siddique, K. H. M., & Plummer, J. A. (2000). Remobilization of carbon and nitrogen supports seed filling in desi and kabuli chickpea subject to water deficit. *Australian Journal of Agricultural Research 51*, 855-866.

Gehring, J. M., & Lewis, A. J. (1980). Effect of hydrogel on wilting and moisture stress of bedding plants. *Journal of American Society of Horticultural Sciences 105*, 511-513.

Halmann, M. (1980). Synthetic plant growth regulators. *Advances in Agronomy 43*, 47-105.

Lentz, R. D., Sojka, R. E., & Robbins, C. W. (1998). Reducing phosphorus losses from surface-irrigated fields: Emerging polyacrylamide technology. *Journal of Environmental Quality 27*, 305-312.

Leport, L., Turner, N. C., French, R. J., Tennant, D., Thomson, D. B., & Siddique, K. H. M. (1998). Water relations, gas exchange and growth of cool season grain legumes in a Mediterranean type environment. *European Journal of Agronomy 9*, 295-303.

Palta, J. A., Nandwal, A. S., Kumari, S., & Turner, N. C. (2005). Foliar nitrogen application increase the seed yield and protein content in chickpea (*Cicer arietinum* L.) subject to terminal drought. *Australian Journal of Agricultural Research 56*, 1-8.

Sahu, M. P., Solanki, N. S., & Dashora, L. N. (1993). Effect of thiourea, thiamin and ascorbic acid on growth and yield of maize (*Zea mays* L.). *Journal of Agronomy and Crop Science 171*, 65-69.

Shooshtarian S, J., Kupai, A., & TehraniFar, A. (2012). Evaluation of application of superabsorbent polymers in green space of arid and semi-arid regions with emphasis on Iran. *International Journal of Forest, Soil and Erosion 2*(1), 24-36.

Werdan, K., Heldt. H. W., & Milovancev, M. (1975). The role of pH in regulation of carbon fixation in chloroplast stoma: Studies on CO_2 fixation in the light and dark. *Biochem. Biophs. Acta 276*, 272-292.

Woodhouse, J. M., & Johnson, M. S. (1991). Effects of soluble salts and fertilizers on water storage by gel forming soil conditioners. *Acta Horticulture 294*, 261-269.