Effect of Hydrogel and Foliar Spray of Agro-chemicals on Productivity of Indian Mustard [*Brassica juncea* (L.) *Czern & Coss*]

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Abstract

The present investigation entitled "Effect of Hydrogel and Foliar Spray of Agro-chemicals on Productivity of Indian Mustard [*Brassicajuncea* (L.) *Czern & Coss*]" was conducted at the Agriculture farm, University of Technology, Vatika, Jaipur during the *Rabi* season (November to February), 2025-26. Oilseed crops are particularly important in the current energy crisis because they are important to India's export trade and agricultural sectors. The situation surrounding oilseeds has drastically changed in recent years; they are now a net source of foreign exchange earnings, which has sparked the "Yellow Revolution." Oil meals and edible oils have been crucial in reducing calorie intake and malnutrition in both human and animal populations. Water stress and other biotic and abiotic challenges are major factors contributing to mustard's low productivity. The crop experiences water stress as a result of the sandy soils in Rajasthan's semi-arid regions having insufficient soil moisture to supply water needs. Hydrogel is a three-dimensional, insoluble, cross-linked polymer that gradually releases water after absorbing more than 400 times its weight. It also enhances the hydro-physical characteristics of soil, including hydraulic conductivity, aggregate stability, and porosity. For thousands of years, agrochemicals have been employed in rudimentary forms to increase agricultural yields. Certain agrochemicals have shown promise in reducing environmental stressors. In this sense, both as an amino molecule like urea and as a sulphydryl chemical, thiourea is essential to plant physiology. The experiment was laid out in the Factorial Randomized Block Design (Factorial RBD) with three replications. The experiment comprised four hydrogel levels (control, 2.5, 5.0 and 7.5 kg ha^{-1}) and four foliar spray treatments (water spray, salicylic acid, thiourea and NPK 19:19:19). Result concluded that the application of hydrogel at 5.0 kg /ha produced significantly higher seed yield (1797kg/ha) along with higher net returns (₹93379 /ha) and B: C ratio (3.82) of Indian mustard. Further, foliar spray of thiourea 500 ppm at pre-flowering and siliqua formation stage gave significantly the highest seed yield (1820kg /ha), net returns(₹95733 /ha) and B: C ratio (3.95) of Indian mustard than foliar spray of NPK (19:19:19) and water spray but statistically at par with salicylic acid.

Key words:- Agro-chemicals, Hydrogel, absorbing, aggregate

Introduction

Indian mustard (*Brassica juncea* (L.) Czern & Coss) is a significant rabi oilseed crop in the nation, ranking second only to soybean and groundnut. It has chromosomal number 2n=36 and is a member of the Brassicacae family. In North India, edible oil from Indian mustard is utilised as a cooking medium. The oil and seed are used to spice vegetables and curries as well as to make pickles. Young plants' leaves are utilised as vegetables. Mustard seeds contain between 37 and 49 percent oil, which is used in cooking and frying for human consumption. Rajasthan leads the nation in both area and mustard and rapeseed output. Despite being a significant oilseed crop, the state's productivity falls well short of its potential output of 2200–2400 kg/ha. Increasing the acreage planted to this crop at the expense of food grain crops is not feasible. Therefore, new crop production technology is the only method to boost output and productivity. Hydrogel is a three-

dimensional, insoluble, cross-linked polymer that gradually releases water after absorbing more than 400 times its weight. It also enhances the hydro-physical characteristics of soil, including hydraulic conductivity, aggregate stability, and porosity (Dabhi *et al.*, 2013). By boosting crop productivity, the application of conditioners such highly absorbent polymer (hydrogel) has a significant potential to take advantage of the water already present in the soil. It is combined with the soil that the seeds are planted in. Water is saved by 40–70% as a result of the use of hydrogel. salicylic acid is crucial to the growth and development of plants for vital physiological functions such boosting the plant's resilience to biotic and abiotic stressors. It is essential for photosynthesis, transpiration, ion uptake, transport, and plant growth and development (Nasrin *et al.*, 2014). Water-soluble fertilizers of a new generation have recently been developed specifically for foliar spraying. NPK (19:19:19) is a 100% water-soluble complete fertilizer with a low salt index that contains 19% each of nitrogen, phosphorus, and potassium. It encourages crops to develop quickly and healthily and swiftly corrects nutrient imbalances.

Materials and Methods

The experiment was laid out in the Factorial Randomized Block Design (Factorial RBD) with three replications. The experiment comprised four hydrogel levels (control, 2.5, 5.0 and 7.5 kg ha^{-1}) and four foliar spray treatments (water spray, salicylic acid, thiourea and NPK 19:19:19). The required quantity of hydrogel was mixed with dry soil and applied in furrows. Required quantity of agro-chemicals dissolved in water was sprayed at pre-flowering and siliqua formation stage of the crop. The foliar spray treatments were applied in early morning with knapsack sprayer.

Result and Discussion

Growth parameters

In the present experiment, the different hydrogel levels significantly enhanced the vegetative growth in terms of plant height, dry matter accumulation, chlorophyll content of leaves, number of primary and secondary branches per plant, crop growth rate at various growth stagesin Indian mustard. The significantly higher value of these growth parameters recorded with application of hydrogel at 5.0 kg /ha which was significantly superior to control and hydrogel at 2.5 kg /ha but remained statistically at par with hydrogel at 7.5 kg /ha.

Improvement in growth attributes with application of hydrogel was the result of the retentive ability of moisture, which helps in enhancing the availability of nutrients. This has helped to increase the meristematic activity, expansion, and elongation of the cells, ultimately leading to increased crop growth (Anupama *et al.*, 2005). Plant growth depends on cell division and enlargement, which is highly dependent on plant-water relations. Augmentation in crop growth parameters with the application of hydrogel might be due to its property of retaining and releasing water to maintain proper soil moisture for longer period in the rhizosphere. Adequate moisture content in soil facilitates better root growth, proper translocation and uptake of nutrients in the soil by the plants, which support better plant growth. Hydrogel also increased availability of macro nutrients as well as micronutrient to the roots of crop which helped in turn to increase in photosynthetic activity of plants that later enhanced the vegetative growth. Singh *et al.* (2017b) reported that the application of 5.0kg hydrogel/ha positively influenced the plant height, dry matter accumulation and number of primary and secondary branches of Indian mustard. Similar to above mentioned results, Meena *et al.* (2020 a) and Meena *et al.* (2020 b) also obtained significantly higher plant height, number of branches, leaf area index and dry matter accumulation of Indian mustard with the application of hydrogel at 5.0 kg /ha. Further findings of the present experiment is well supported by earlier results obtained by Singh *et al.* (2017c), Jat *et al.* (2018), Ram *et al.* (2018) and Choudhary *et al.* (2021) in mustard and other field crops.

Conclusion

Result concluded that the that application of hydrogel at 5.0 kg /ha produced significantly higher seed yield (1797kg/ha) along with higher net returns (₹93379 /ha) and B: C ratio (3.82) of Indian mustard. Further, foliar spray of thiourea 500 ppm at pre-flowering and siliqua formation stage gave significantly the highest seed yield (1820kg /ha), net returns(₹95733 /ha) and B: C ratio (3.95) of Indian mustard than foliar spray of NPK (19:19:19) and water spray but statistically at par with salicylic acid.

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Table no. 1: Effect of hydrogel and foliar spray of agro-chemicals on growth parameters of Indian mustard

Treatment	Plant stand/m row length		Plant height (cm)			Dry matter accumulation (g/m row length)			Chlorophyll content (mg/g)
	At 20 DAS	At harvest	At 40 DAS	At 80 DAS	At harvest	At 40 DAS	At 80 DAS	At harvest	At 55 DAS
Hydrogel									
Control	10.0	9.3	41.8	130.4	144.8	53.5	123.7	188.4	2.75
2.5kg/ha	10.1	9.4	51.2	161.1	171.3	67.5	155.2	235.8	3.06
5.0kg/ha	10.2	9.5	57.3	178.8	190.8	72.4	166.1	252.8	3.22
7.5kg/ha	10.3	9.6	57.5	182.1	194.0	73.1	169.1	257.5	3.26
SEm±	0.3	0.2	1.2	3.9	4.3	1.5	3.2	5.5	0.04
CD (P=0.05)	NS	NS	3.4	11.2	12.3	4.2	9.3	15.8	0.11
Agro-chemicals (Foliar spray)									
Water spray	10.0	9.3	50.6	138.0	148.0	64.2	125.9	190.3	2.77
Thiourea500ppm	10.3	9.5	53.1	178.7	192.6	68.3	167.9	257.9	3.18
Salicylicacid100ppm	10.1	9.4	51.5	163.9	175.7	67.5	163.5	248.5	3.10
NPK(19:19:19)0.5%	10.2	9.5	52.6	171.7	184.5	66.6	156.8	237.9	3.23
SEm±	0.3	0.2	1.2	3.9	4.3	1.5	3.2	5.5	0.04
CD (P=0.05)	NS	NS	NS	11.2	12.3	NS	9.3	15.8	0.11
CV (%)	9.0	8.7	7.9	8.2	8.4	7.6	7.2	8.1	4.46

Table no. 2: Effect of hydrogel and foliar spray of agro-chemicals on growth parameters of Indian mustard

Treatment	Number of primary branches/plant			Number of secondary branches/plant			Crop growth rate (g /m^2/day)		Relative growth rate (mg/g/day)	
	At 40 DAS	At 80 DAS	At harvest	At 40 DAS	At 80 DAS	At harvest	At 40-80 DAS	At 80 DAS-at harvest	At 40-80 DAS	At 80 DAS-at harvest
Hydrogel										
Control	2.5	3.3	4.0	6.8	7.0	9.9	5.8	3.9	69.1	25.5
2.5kg/ha	2.6	3.9	4.7	7.0	8.5	11.9	7.3	4.9	68.9	25.3
5.0kg/ha	2.7	4.2	5.0	7.2	9.3	12.9	7.8	5.3	68.8	25.4
7.5kg/ha	2.7	4.3	5.2	7.3	9.5	13.3	8.0	5.4	69.4	25.4
SEm±	0.05	0.10	0.11	0.16	0.23	0.30	0.2	0.2	1.4	0.7
CD (P=0.05)	NS	0.28	0.32	NS	0.66	0.86	0.6	0.5	NS	NS
Agro-chemicals (Foliar spray)										
Water spray	2.6	3.4	4.0	6.8	7.2	10.1	5.1	3.9	70.9	25.0
Thiourea500ppm	2.7	4.3	5.1	7.3	9.5	13.2	8.3	5.5	74.9	26.0
Salicylicacid100ppm	2.6	4.1	4.9	7.2	9.0	12.7	8.0	5.2	73.8	25.4
NPK(19:19:19)0.5%	2.6	3.9	4.7	7.0	8.6	12.0	7.5	4.9	71.4	25.1
SEm±	0.05	0.10	0.11	0.16	0.23	0.30	0.2	0.2	1.4	0.7
CD (P=0.05)	NS	0.28	0.32	NS	0.66	0.86	0.6	0.5	NS	NS
CV (%)	7.2	8.6	8.2	8.0	9.2	8.6	9.7	13.3	7.1	9.1