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Effect of hydrogel and foliar nutrition sprays on growth and productivity of chickpea

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Abstract
A field experiment was conducted at R.A.K. college of Agriculture, Sehore (M.P.), during rabi 2021-22. The experiment comprised of 3 hydrogel levels (i.e. 0, 2.5 kg/ha & 5.0 kg/ha) were kept in main plots and 5 levels of foliar nutrition i.e., water spray, 2% urea, thiourea 500 ppm, salicylic acid 75 ppm & NPK (19:19:19) @ 0.5% in sub plots. Hydrogel was drilled 7-8 cm deep into the soil before sowing in earmarked strips and subsequently foliar nutrition were sprayed at critical stages i.e. flower initiation and pod development. Result revealed that drilling of hydrogel 5.0 kg/ha before sowing recorded significantly higher plant height (41.76 cm), branches (5.18), dry matter (28.65), pods/plant (51.41), seeds per pods (1.35), seed index (21.54), grain yield (2024 kg/ha), straw yield (2332 kg/ha) and harvest index (46.42%). Foliar application of NPK (19:19:19) @ 0.5% at flower initiation & pod development stages recorded significantly higher plant height (43.06 cm), branches (5.84), dry matter (30.72), pods/plant (55.50), seeds per pods (1.41), seed index (21.66), grain yield (2166 kg/ha), straw yield (2532 kg/ha) and harvest index (46.04%).

Keywords: Branches, significantly, initiation, development

Introduction
Chickpea (*Cicer arietinum* L.) is one of the oldest pulse crops, grown in tropical, subtropical and temperate regions of the world and is consumed widely across the world. Vavilov (1926) was the first to identify the Near Eastern, Central Asian, Indian and Mediterranean regions as the probable centers of origin for chickpea. The International Crops Research Institute for Semi-Arid Tropics (ICRISAT) has reported that chickpea seeds contain on average 23% protein, 64% total carbohydrates (47% starch, 6% soluble sugars), 5% fat, 6% crude fibre and 3% ash. Studies have also shown that chickpea helps lower blood cholesterol (Pittaway *et al.*, 2008) [9] hence, it reduces malnutrition and improves human health. The consumption of chickpea also reduces the risk of chronic diseases and optimizes health.

The effect of shortage of water can be compensated by increasing the available water in soils by the use of polymers is one of the best option. The super absorbent polymer hydrogel potentially influence soil permeability, density, structure, texture, evaporation and infiltration rates of water through the soils. Particularly, the hydrogels reduce irrigation frequency and compaction tendency, stops erosion, water runoff and increase the soil aeration and microbial activity. The efficiency of applied hydrogel can be enhanced by keeping it moist throughout the crop period by irrigations. In rainfed conditions it may quickly dry out and disintegrate because of lack of soil moisture. It also reduces irrigation amount from 100 to 85% of the crop water requirements and increase crop yield (El-Hady *et al.*, 2006) [2]. The excellent water absorbency and water retention by hydrogel may prove especially practical in irrigated agriculture.

Hydrogels are polymers that absorb aqueous solutions through hydrogen bonding with water molecules (Narjary *et al.*, 2013) [6]. These hydrogels are used in agriculture because they aid in water retention, thus facilitating crop production and increasing yields by decreasing water stress, increasing water holding capacity, decreasing fertilizer leaching, and enhancing water permeability (Narjary *et al.*, 2013) [6]. Hydrogel can absorb and hold water up to 80–180 times its original volume, while it can absorb up to 400 times its original weight (Singh *et al.*, 2016) [12]. Further, hydrogel addition improved water storage properties of porous soils and resulted in the delay and onset of permanent wilting percentages under intense evaporation. An increase in water holding capacity due to hydrogel significantly reduced the irrigation requirement of many plants (Taylor and Halfacre 1986) [13]

Foliar nutrition is a technique that involves providing nutrients to the plant by applying liquid fertilizer directly to the canopy of the crop. The amount of fertilizer required for foliar application is very small, and the plant receives the nutrients directly. Increasing photosynthetic efficiency, assimilate partitioning, growth, and yield may be possible by foliar feeding using bio-regulators and nutrient sprays (Patil and Chetan 2018) [8]. Heat and temperature extremes during crop developmental phases (Especially flowering and pod development during moisture stress) are the main factors impacting the production of rabi pulses. Seed filling and blossom drop are caused by these circumstances. The reduction in photosynthetic activity brought on by a nitrogen scarcity in plants speeds up the senescence of leaves, which is crucial for encouraging subsequent phases of pod development, which depend on carbon and nitrogen accumulation. In addition to higher expenses, providing nitrogen through soil may also result in roots' reduced ability to absorb nutrients when it's dry (Ram *et al*., 2018) [16]. Keeping this in view, a field experiment was carried out to find out the effective dose of hydrogel with suitable foliar nutrition at critical stages for enhancing growth and productivity and of Chickpea under vertisols.

Materials and Methods

The research trial was laid out in field of R.A.K. college of Agriculture, Sehore (M.P.), during Rabi 2021 on the Chickpea variety RVG-202. The global position of the site was situated in the Eastern part of Vindhyan Plateau in subtropical zone at the latitude of 27º15' North and longitude of 77º05' East at an altitude of 498.77 m from mean sea level (MSL) in Madhya Pradesh. The average annual rainfall varies from 1000 to 1200 mm concentrated mostly from June to September. The mean annual maximum and minimum temperatures are 33.3 °C and 20.2 °C, respectively. The experiment comprised of 3 hydrogel levels (i.e. 0.0, 2.5 kg/ha & 5.0 kg/ha) were kept in main plots and 5 levels of foliar nutrition i.e., water spray, 2% urea, thiourea 500 ppm, salicylic acid 75 ppm & NPK (19:19:19) @ 0.5% in sub plots. The experiment was laid out in split plot design and replicated three times. The soil of the experimental field was medium black belongs to the order Vertisol that was popularly known as "black cotton soil", slightly alkaline in reaction (pH 7.4), poor in organic carbon (0.40%), low in available N (238 kg/ha) and medium in available P (15.8 kg/ha) and K (315 kg/ha). Hydrogel was applied in soil before sowing in earmarked strips and subsequently foliar nutrition were sprayed at critical stages i.e. flower initiation and pod development. The recommended dose of fertilizer (20 kg N, 50 kg P, 20 kg K per ha) was drilled in the soil at the time of sowing. In each plot five plants were randomly selected and tagged to record biometric observations on growth (plant height, branches/plant and dry matter accumulation) and yield attributes (pods/plant, seeds/pod, 100-seed weight) and yield.

Results and Discussion

Growth parameters

The results showed that drilling of hydrogel had positive effect on plant growth parameters as compared to no hydrogel drilling in the soil recorded at 30 DAS, 50 DAS, 70 DAS and at maturity (Table 1). Application of hydrogel 5.0 kg/ha before sowing recorded maximum plant height (16.62, 29.84, 37.95 and 41.76 cm), number of branches/plant (2.34, 3.50, 5.18 and 5.11) and dry matter accumulation (2.38, 5.35, 11.32 and 8.65 g) and found to be significant at 70 DAS and at maturity stage. Drilling of super absorbent helps in cell division, cell elongation and stem elongation which inturn enhances the vegetative growth of the plant. The coating with hydrogels to seeds at the time of sowing can potentially improve the water availability for the early growth and development of plants under dry conditions and therefore, prevent associated delays in the development of plant parts reported by Ismail *et al.*, (2013) [5]. Similar findings were reported that plant height of maize and wheat increased with hydrogel application of 2.5 to 5 kg/ha reported by Islam *et al.*, (2011) [4] and Roy *et al.*, (2019) [11] respectively.

Foliar application of nutrients at flower initiation and pod development stages had positive effect on increasing growth parameters. foliar application of NPK (19:19:19) @ 0.5% at flower initiation & pod development stages recorded significantly maximum plant height (17.05, 30.38, 38.79 and 43.06 cm), higher number of branches/plant (2.24, 3.54, 5.83 and 5.84) and dry matter accumulation (2.34, 5.66, 12.33 and 30.72 being on par with urea 2% over water spray. The increase in growth parameters were due to better absorption of nutrients applied through foliage leading to better activity of functional root nodules resulting in more dry-matter production and uptake of nutrients. Verma *et al.*, (2009) [14] suggested that the significantly higher growth were found with foliar application of urea @ 1.00% at 50% flowering stage. Similar results were reported by Ravichandra *et al.*, (2015) [10].

The interaction between hydrogel application and foliar spray was found to be non-significant during the study.

Table 1: Influence of different treatment on growth parameters of chickpea

Treatments	Plant height (cm)				Number of branches plant^{-1}				Dry matter plant^{-1} (g)			
	30 DAS	50 DAS	70 DAS	At maturity	30 DAS	50 DAS	70 DAS	At maturity	30 DAS	50 DAS	70 DAS	At maturity
Hydrogel application												
0 kg ha^{-1}	15.00	26.93	33.03	36.63	2.11	3.16	4.38	4.43	2.15	4.87	9.57	25.13
2.5 kg ha^{-1}	16.12	28.93	35.01	37.97	2.27	3.39	4.62	4.67	2.31	5.25	10.13	26.21
5.0 kg ha^{-1}	16.62	29.84	37.95	41.76	2.34	3.50	5.18	5.11	2.38	5.35	11.32	28.65
S.Em.(±)	2.13	3.91	0.49	0.93	0.33	0.47	0.13	0.09	0.35	0.91	0.26	0.55
CD at 5%	NS	NS	1.92	3.64	NS	NS	0.51	0.36	NS	NS	1.01	2.15
Foliar nutrition												
Water spray	14.95	26.86	31.32	33.26	2.04	3.03	3.70	3.73	2.12	4.86	8.36	22.88
Urea @ 2%	16.25	29.30	36.63	40.97	2.33	3.56	5.03	5.04	2.20	5.23	11.23	28.04
Thiourea @ 500 ppm	14.90	27.47	33.62	37.71	2.39	3.32	4.34	4.35	2.45	5.15	9.39	25.08
Salicylic acid @100 ppm	16.42	28.82	36.29	38.94	2.19	3.29	4.72	4.73	2.29	4.90	10.38	26.59
NPK (19:19:19) @ 0.5%	17.05	30.38	38.79	43.06	2.24	3.54	5.83	5.84	2.34	5.66	12.33	30.72
S.Em.(±)	1.86	3.35	1.73	1.64	0.27	0.39	0.20	0.21	0.25	0.58	0.44	1.19

CD at 5%	NS	NS	5.05	4.78	NS	NS	0.59	0.61	NS	NS	1.28	3.47
Interaction: Hydrogel × Foliar nutrition												
S.Em.(±)	0.62	1.12	0.59	0.55	0.09	0.13	0.07	0.07	0.08	0.19	0.15	0.40
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Yield and Yield Attributes

The results showed that application of hydrogel had positive effect on yield and yield attributes as compared to without application of hydrogel in the soil (Table 2). Application of hydrogel 5.0 kg/ha before sowing significantly recorded maximum number of pods/plant (51.41), grain yield per plant (8.27 g), 100 seed weight (21.54 g), seed yield (2024 kg/ha), straw yield (2332 kg/ha) and harvest index (46.42%). However, number of seeds/pod found non-significant and recorded maximum value under hydrogel 5.0 kg/ha (1.35) as compared to control. This may be because hydrogel saves water, creating a buffered environment that reduces losses during the chickpea plant's early establishing phase and is effective in reducing short-term drought tension. Therefore, hydrogel a super absorbent polymer improves plant growth by enhancing soils' ability to store water (Boatright *et al*., 1997) [1] and delaying the duration to wilting point in drought stress (Gehring and Lewis, 1980) [3]. Thus, the use of super absorbent causes plants to respond positively in terms of dry matter production and total proficiency in water consumption (Woodhouse and Johnson, 1991) [15].

Foliar application of nutrients at flower initiation and pod development stages had positive effect on increasing yield attributes of chickpea. Results revealed that foliar application of NPK 19:19:19 @ 0.5%, at flower initiation & pod development stages recorded significantly higher number of pods/plant (56.50), number of seeds/pod (1.41), yield per plant (9.98 g), 100 seed weight (23.45 g) seed yield (2166 kg/ha), straw yield (2532 kg/ha) and harvest index (46.04%) at par with urea 2%. This might be probably spray of NPK 19:19:18 @ 0.5% and urea 2% spray improved nitrogen supply to leaf by foliar absorption might have delayed the senescence of leaves and allowed greater soil total assimilation and carbon remobilization to the seeds of additional pods reported by Palta *et al.*, 2005 [7].

The interaction between hydrogel application and foliar spray was found to be non-significant during the study.

Table 2: Influence of different treatment on yield and yield attributing parameters of chickpea

Treatments	Yield and Yield attributing characters						
	Number of pods plant^{-1}	Number of seeds pod^{-1}	Grain yield plant^{-1} (g)	Seed index (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
Hydrogel application							
0 kg ha^{-1}	46.40	1.20	7.19	19.43	1631	2057	44.17
2.5 kg ha^{-1}	48.23	1.31	7.90	20.88	1846	2233	45.23
5.0 kg ha^{-1}	51.41	1.35	8.27	21.54	2024	2332	46.42
S.Em.(±)	0.72	0.19	0.06	0.14	43.77	23.00	0.10
CD at 5%	2.81	NS	0.25	0.57	171.85	90.32	0.38
Foliar nutrition							
Water spray	38.55	1.13	5.72	17.16	1470	1809	44.76
Urea @ 2%	52.83	1.36	8.91	21.88	1971	2373	45.30
Thiourea @ 500 ppm	46.10	1.25	6.64	19.95	1749	2124	45.10
Salicylic acid @100 ppm	49.40	1.28	7.69	20.66	1814	2198	45.14
NPK (19:19:19) @ 0.5%	56.50	1.41	9.98	23.45	2166	2532	46.04
S.Em.(±)	2.36	0.04	0.43	0.93	86.47	89.35	0.31
CD at 5%	6.90	0.11	1.26	2.72	252.38	260.81	0.89
Interaction: Hydrogel × Foliar nutrition							
S.Em.(±)	0.79	0.01	0.14	0.31	28.82	29.78	0.10
CD at 5%	NS	NS	NS	NS	NS	NS	NS

Conclusion

From the present investigation it was concluded that the application of hydrogel 5.0 kg/ha before chickpea sowing was found higher growth, yield attributes and seed yield of chickpea. And the foliar nutrition treatment with the spray of NPK 19:19:19 @ 0.5% at flower initiation and pod development was found the best practices for getting higher production in chickpea under rainfed condition. Hence, hydrogel 5.0 kg/ha along with foliar application of either NPK 19:19:19 @ 0.5% may become practically convenient and economically possible and successful option in water-stressed areas for increasing agricultural productivity.

References

1. Boatright JL, Balint DE, Mackay WA, Zajicek JM. Incorporation of a hydrophilic polymer into annual landscape beds. J Environ Hortic. 1997;15:37-40.
2. El Hady OA, Wanas SA. Water and fertilizer use efficiency by cucumber grown under stress on sandy soil treated with Acrylamide Hydrogels. J Appl Sci Res. 2006;12:1293-1297.
3. Gehring JM, Lewis AJ. Effect of hydrogel on wilting and moisture stress of bedding plants. J Am Soc Hortic Sci. 1980;105:511-513.
4. Islam MR, Mao S, Jia P, Eneji AE, Xue X. Effects of water saving superabsorbent polymer on antioxidant enzyme activities and lipid peroxidation in corn (*Zea mays* L.) under drought stress. J Sci Food Agric. 2011;91:813-819.
5. Ismail M, Irani, Ahmad Z. Starch-based hydrogels: present status and applications. Int J Polymeric Mater. 2013;62(7):411-420.
6. Narjary B, Aggarwal P, Kumar S, Meena M. Significance of hydrogel and its application in agriculture. Indian

Farming. 2013;62(10):15-17.
7. Palta JA, Nandwal AS, Kumari S, Turner NC. Foliar nitrogen application increase the seed yield and protein content in chickpea (*Cicer arietinum* L.) subject to terminal drought. Aust J Agric Res. 2005;56:1-8.
8. Patil B, Chetan HT. Foliar fertilization of nutrients, Marumegh Kisan E-Patrika. 2018;3(1):49-55.
9. Pittaway JK, Robertson IK, Ball MJ. Chickpeas may influence fatty acid and fibre intake in an ad libitum diet, leading to small improvements in serum lipid profile and glycemic control. J Am Diet Assoc. 2008;(6):1009-1013.
10. Ravichandra K, Jyothi CN, Singh BJ, Dawson J, Krupakar A. Growth of groundnut (*Arachis hypogaea* L.) and its yield as influenced by foliar spray of boron along with Rhizobium inoculation. Indian J Dryland Agric Res Dev. 2015;30(1):60-63.
11. Roy T, Maurya UK, Singh M, Muruganandam M, Singh Lakhan, Sharma SK. Impact of Pusa hydrogel application on yield and productivity of rainfed wheat in North West Himalayan region. Curr Sci. 2019;116(7):1246-1251.
12. Singh NP, Praharaj CS, Sandhu JS. Utilizing untapped potential of rice fallow of East and North-east India through pulse production. Indian J Genet. 2016;76:388-398.
13. Taylor KC, Halfacre RG. The effect of hydrophilic polymer on media water retention and nutrient availability to *Ligustrum lucidum*. Hort Sci. 1986;21:1159–1161.
14. Verma CB, Yadav RS, Singh IJ, Singh AK. Physiological traits and productivity of rainfed chickpea in relation to urea spray and genotypes. Legume Res. 2009;32:103-110.
15. Woodhouse J, Johnson MS. Effect of superabsorbent polymers on survival and growth of crop seedlings. J Agric Water Manag. 1991;20(1):63-70.
16. Ram JL, Conn PM, editors. Conn's handbook of models for human aging. Academic Press; c2018 Apr 5.
17. Kondapalli AS, Lavanya GR. Induced chemical mutagen in m1 generation of chickpea (*Cicer arietinum* L.).