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Effect of seed enhancement treatment and seed rate on morphological components of chickpea

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Abstract
Seed treatment with chemicals and coating with protectant enhance the seed yield and yield attributes of chickpea. The experiment consisted of six seed treatment combinations and one control and four seed rates in chickpea variety JG 14. The number of pods, nodes per plant and biological yield varied significantly as effect of various population densities which were higher at lower plant density and vice versa. Among the treatments significantly maximum number of nodes and pods per plant and biological yield were produced by Thiamethoxam @ 3g/ kg seed + Vitavax @ 2g/kg seed and the values were minimum in control. Significantly maximum and minimum harvest index was recorded in 45 kg and 75 kg seed rate per hectare respectively. Significantly maximum seed yield was produced by planting 45 kg seed rate per hectare and it was significantly lower in 75 kg /ha seed rate. Treatment with Vitavax and Thiamethoxam resulted in low insect and pathogen infection ultimately producing healthier plants ultimately leading to higher biological and seed yield.

Keywords: Thiamethoxam, enhancement treatment, plant population

Introduction
Chickpea is a main source of dietary protein and one of the main pulse crops in India. It is high in dietary fiber and significant source of protein (20-22%), calcium, zinc, phosphorus, vitamin and iron (Hulse 1991) [4]. India is the largest producer of chickpea with 65% global production (Gonzolis *et al* 2010) [3]. The yield in India ranges from 8-10 Q/ha. However, the demand of modern agriculture is to get maximum yield from limited area to feed the increasing population of the country.
Seed enhancement treatment are done to improve the performance of low vigour seed lots by modifying the physiological and bio-chemical nature of the seed, thus affecting crop establishment leading to improvement in yield attributes. The substances commonly applied are bio-active chemicals, fungicides, insecticides and botanicals etc. Rathinavel and Dharmalingam (2000) [5] also worked on upgradation of seed quality by halogenation and other seed enhancement treatment treatments in crops. Keeping this in view a study was conducted with an objective to evaluate the effect of seed treatment with chemicals and coating with protectant on seed yield and yield attributes of chickpea.

Method and Material
The experiment was carried out in the Research farm of Adhartal, Jabalpur with chickpea variety JG 14. The field was laid out in a Split Plot Design with six seed treatment combinations and one control and four seed rates as mentioned below:
T_1 - Control
T_2 - Thiamethoxam @ 3g/kg seed
T_3 - Thiamethoxam @ 3g/kg seed + Thiram @ 2g/kg seed
T_4 - Thiamethoxam @ 3g/kg seed + Bavistin @ 2g/kg seed
T_5 - Thiamethoxam @ 3g/kg seed + Vitavax @ 2g/kg seed
T_6 - Thiamethoxam @ 3g/kg seed + Halogenation mixture @ 2g/kg seed
T_5 - Thiamethoxam @ 1.5 g/kg seed + Thiram 1 g/kg seed + Bavistin @ 1 g/kg seed + Vitavax @ 1g/kg seed.

Seed rate:
P_1 - 75Kg/ha
P_2 - 65Kg/ha
P_3 - 55Kg/ha
P_4 - 45Kg/ha

The soil of Jabalpur is classified as 'vertisol'. The soil is black in colour with clay - loam texture and swells by wetting and shrinks o drying. The basic fertilizer dose applied was N:P:K:20:60:40 (kg/ha) respectively.

Seed treatment of chickpea genotype was done with the mentioned treatments and shade dried to normal safe moisture content. The field was prepared and seeds sown in the field @ 75kg, 65kg, 55 kg and 45 kg respectively at depth of 4-5 cm. in open furrows. The morphological yield attributing parameters were quantified at maturity. The pooled data was statistically analyzed through analysis of variance in split plot design.

Results and Discussion

The number of pods, nodes per plant and biological yield varied significantly as effect of various population densities. Seed rate of 45 kg / ha exhibited significantly maximum number of pods and nodes per plant and it was minimum in 75 kg / ha seed rate. As per Roshan *et al*. (1998) [6] pod number is a major component affecting economic yield in crops. Similar was the effect in biological yield. Among the treatments significantly maximum number of nodes and pods per plant and biological yield were produced by Thiamethoxam @ 3g/ kg seed + Vitavax @ 2g/kg seed and the values were minimum in control. The interaction effect of population and treatment was significantly maximum in 45 kg seed rate per hectare along with Thiamethoxam @ 3g/kg seed + Vitavax @ 2g / kg seed and minimum in 75 kg / ha seed rate in control for all the three parameters. Increase in number of nodes and pods per plant could be due to efficient partitioning of assimilates from source to sink in as there was less competition among individual plants at 45 kg seed rate / ha. Doyle *et al*. (2001) [2] also found seed treatment with Thiamethoxam to acquire good vigour, healthy stand establishment, early flowering and high yield. The seed rate had a significant and positive impact on Harvest index (HI) in the experiment. Harvest index is an estimate of the partitioning of dry matter between the seeds and the leaves and plays a dominating role in regulating seed yield in chickpea (Chaudhary *et al* 1989) [1]. Significantly maximum and minimum harvest index was recorded in 45 kg and 75 kg seed rate per hectare respectively. Various treatments affected the Harvest Index significantly. Maximum HI was observed in Thiamethoxam @ 3g/kg seed + Bavistin @ 3g/kg seed and minimum harvest index was noted in Thiamethoxam @ 3g/kg seed. Interaction of population density and treatment was significantly maximum in 45 kg seed rate in combination with Thiamethoxam @ 3g/kg seed + Bavistin @ 2g/kg seed treatment, while it was minimum in 75 kg per hectare seed rate in control. The economical yield (seed yield) varied significantly as effect of different seed rates. Significantly maximum seed yield was produced by planting 45 kg seed rate per hectare and it was significantly lower in 75 kg /ha seed rate which was at par with 65 kg/ha seed rate. Among treatments seed treatment with thiamethoxam @3 g/kg seed + Vitavax @ 2g/kg seed recorded significantly higher seed yield which varied non-significantly from thiamethoxam @3 g/kg seed + Bavistin @ 2g/kg seed while it was minimum in control. Interaction PXT was significantly maximum in combination of 45 kg seed rate with thiamethoxam @3 g/kg seed + Bavistin @ 2g/kg seed and minimum in control with 65 kg seed rate. Lesser plant density in 45 kg seed rate resulted in less competition for light and increased PAR absorption which ultimately was effective in increasing the biological yield, seed yield and harvest index. Significant variations were seen as effect of seed rate and different treatments on seed index. Significantly maximum and minimum seed index was recorded in 45kg and 75 kg seed rate per hectare respectively. Seed treatment with thiamethoxam @3 g/kg seed + Vitavax @ 2g/kg recorded significantly maximum and control minimum seed index. Population x Treatment interaction was significantly maximum in 45 kg seed rate combined with thiamethoxam @3 g/kg seed + Bavistin @ 2g/kg and it was minimum in control of 75 kg seed rate. Vijayraghawan *et al* (2003) [9] and Singh and Singh (1989) [1, 8] also found that the plant biomass, yield per plant, number of pods per plant and seed yield to be higher in low plant density. The rate of seed filling varied with population density as at high population density it could not utilize the absorbed radiant energy to full extent whereas at lower plant density it had superior ability to translocate maximum photosynthate to sink resulting in increased seed yield as has also been reported by Sharma and Chakravarty (1992) [7]. Treatment with Vitavax and Thiamethoxam resulted in low insect and pathogen infection ultimately producing healthier plants ultimately leading to higher biological and seed yield.

Table 1: Effect of seed enhancement treatments and seed rate on number of leaves / plant in chickpea

Treatment	No. of Nodes/plant	No. of pods / plant	Seed index	Harvest Index	Biological yield (Q/ha)	Seed yield (Q/ha)
P_1T_1	40.88	43.33	22.04	29.72	41.64	16.63
P_1T_2	43.88	45.67	23.45	30.36	59.65	21.83
P_1T_3	42.77	48.33	23.59	30.08	59.33	22.53
P_1T_4	46.33	56.00	22.68	30.82	67.41	24.25
P_1T_5	48.22	60.33	22.88	30.93	69.63	24.59
P_1T_6	43.08	55.33	23.82	30.44	58.33	23.03
P_1T_7	41.88	63.00	22.88	30.17	52.71	19.83
Mean	43.58	53.14	23.00	30.36	58.38	21.81
P_2T_1	45.88	44.33	22.12	29.90	51.52	25.56
P_2T_2	46.22	46.67	22.90	28.05	66.73	28.16
P_2T_3	47.89	49.33	23.05	27.86	66.64	30.14
P_2T_4	48.06	57.00	23.25	31.73	67.64	26.17
P_2T_5	48.44	61.33	23.57	32.29	69.65	28.86
P_2T_6	46.75	56.33	23.74	31.21	61.63	27.95
P_2T_7	46.46	64.00	23.17	29.49	62.63	28.93
Mean	47.10	54.14	23.11	30.08	63.73	27.96
P_3T_1	47.44	61.67	22.14	32.09	63.33	35.11
P_3T_2	49.09	62.67	23.68	30.30	73.33	33.50
P_3T_3	48.66	62.67	24.03	31.18	70.34	34.59
P_3T_4	50.10	63.00	23.92	29.85	78.63	37.02
P_3T_5	52.33	69.33	23.36	28.30	79.88	35.39
P_3T_6	49.44	64.33	23.55	30.55	71.48	32.16
P_3T_7	48.17	63.33	23.85	30.73	70.68	35.33
Mean	49.32	64.00	23.50	30.52	72.57	34.72
P_4T_1	49.66	62.67	22.02	29.83	70.33	43.06
P_4T_2	52.44	63.67	23.68	32.34	77.33	41.62
P_4T_3	51.22	63.67	23.90	31.06	74.41	41.75
P_4T_4	53.66	64.00	24.13	33.81	82.00	43.42
P_4T_5	54.01	70.67	24.46	34.14	84.70	43.99
P_4T_6	52.44	61.33	23.36	31.58	74.68	39.71
P_1T_7	51.14	62.33	23.83	31.28	74.64	42.27
Mean	52.02	64.04	23.62	32.01	76.87	42.26
S. Em ±						
P	0.02	0.27	0.06	0.07	0.13	0.10
T	0.03	0.34	0.01	0.09	0.10	0.01
PXT	0.06	0.69	0.02	0.18	0.20	0.27
C. D. at 5%						
P	0.02	0.67	0.15	0.17	0.32	0.24
T	0.07	0.70	0.02	0.18	0.21	0.03
PXT	0.12	1.40	0.03	0.36	0.41	0.06

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