International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(6): 541-544

Received: 09-09-2017
Accepted: 10-10-2017

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Effect of seed priming on growth and seed yield of kabuli chickpea cv., MNK – 1 (*Cicer arietinum* L.)

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Abstract
A field experiment was conducted to know the effect of priming treatments on growth and seed yield of kabuli chickpea at UAS Raichur. The experiment consists of 11 treatments with three replications in RCBD design. The results revealed that seeds primed with GA_3 @ 50 ppm + seed coating of *Trichoderma harzianum* @ 15 g per kg of seed recorded significantly higher plant height (17.80 cm, 38.50 cm and 59.60 cm) at 30 days, 60 days and at harvest, test weight (54.67 g), less number of days to 50 per cent flowering (66 days), more number of pods per plant (33). Whereas, seeds treated with mancozeb 50% + carbendazim 25% @ 3 g per kg of seed recorded significantly higher seed yield per plant (21 g), seed yield per hectare(1869 kg/ha), biomass (2878 kg/ha), harvest index (42.12) and lowest wilt (1.67 %) and *Ascochyta* blight incidence (4.66 PDI).

Keywords: Chickpea, Hydration, Seed priming, Seed treatment

Introduction
Chickpea is a major and cheap source of protein, predominantly consumed in the form of whole grain or dhal, sprouted grain, green or matured dry seeds. It has highly digestible protein (21.1%), carbohydrates (61.5%) and fats (4.5%) and also rich in fibre, minerals and β-carotene. There are two types of chickpea *viz*., desi and kabuli grown in the world. Out of two types of cultivars grown in India, kabuli type occupies nearly 15 per cent and desi types occupy about 85 per cent of area. Kabuli chickpea is having good market value compared to desi chickpea but requires more specific environmental condition and greater attention to crop management than desi chickpea to produce a quality seed. The kabuli chickpea variety is bold seededness, require more soil moisture for emergence, having erect growth habit and grows upto 50 to 60 cm, produces 48 to 55 pods per plant, matures in 95-110 days and moderate resistant to wilt reaction. About 90 per cent of the chickpea is cultivated under rainfed condition hence they frequently experiences terminal drought stress resulting in low and unstable yields (Toker *et al.,* 2007) [12]. Insufficient seedling emergence and inappropriate stand establishment are the main constraints in the production of kabuli chickpea crop, this is because of its thin seed coat and susceptibility to soil borne pathogens especially to the *Fusarium* wilt under rain fed condition. Sometimes, non-availability of quality seed is also one of the major drawback in enhancing the productivity. Hence, use of quality seeds is an effective means of improving the crop yields by using different techniques particularly under rainfed conditions. One of the simple techniques which can improves seedling vigour and establishment and consequently crop performance in the field is seed priming (Khan *et al*., 2005) [5]. Priming is a pre-sowing seed treatment which permits early DNA replication, increase RNA and protein synthesis, repairs deteriorated seed parts and reduces the leakage of metabolites thus enhances the embryo growth, speed and uniformity of seedlings in field and increases the drought tolerance, reduce pest damage and increase crop yield (Sen, and Osborne, 1974) [10]. Keeping above facts in mind, the field experiment was designed with an objective to know the effect of priming treatment on growth, seed yield and quality of kabuli chickpea.

Material and methods
A field experiment was conducted during *Rabi* 2015-16 at Main Agriculture Research Station, College of Agriculture, University of Agricultural Sciences,

Raichur to investigate the effect of priming treatments on growth and seed yield of kabuli chickpea cv. MNK-1. The experiment was laid out in RCBD with three replications. The experiment consisted of 11 treatments *viz*., seed priming with *Trichoderma harzianum* @ 1.5% (T_1), seed priming with vitavax power @ 0.25% (T_2), seed priming with GA_3 @ 50 ppm (T_3), seed priming with GA_3 @ 50 ppm + seed coating with *Trichoderma harzianum* @ 15 g per kg of seed (T_4), seed priming with sodium molybdate @ 500 ppm (T_5), seed priming with sodium molybdate @ 500 ppm + seed coating with *Trichoderma harzianum* @ 15 g per kg of seed (T_6), seed coating with extract of *Lantana camera* @ 10 % (T_7), hydration (T_8), seed treatment with carbendazim @ 3 g per kg of seed (T_9), seed treatment with mancozeb 50% + carbendazim 25% (sprint) @ 3 g per kg of seed (T_{10}) and untreated control (T_{11}). The observation on plant height at 30, 60 days after sowing and at harvest were recorded. The observation on days to 50 per cent flowering was recorded when 50 per cent of the plants to produce first flower in each plot. The number of root nodules per plant was recorded at flowering stage. The yield attributing parameters *viz.,* number of pods per plant, seed yield per plant, seed yield per hectare, biomass and harvest index were recorded at harvesting stage. The wilt and *Ascochyta* blight incidence was conducted at weekly intervals by counting the number of infected plants over total number of plants in the field and expressed as percentage. The data collected from the above observations were analyzed statistically by the procedure prescribed by Panse and Sukhatme (1967) [8].

Result and discussion

The need for high plant population density and uniform plant stand requires seeds of high quality that will consistently produce rapid and influence on uniform seedling emergence from each seed sown. In the present investigation significant variation due to seed priming and seed treatment with chemicals, growth regulator and biological agents were observed for growth parameters like plant height throughout the crop period and 50 per cent flowering. Significantly taller plants were recorded at 30, 60 DAS and at harvest when seeds primed with GA_3 @ 50 ppm + seed coated with *Trichoderma. harzianum* @ 15 g/kg of seed (T_4) (17.80 cm, 38.50 cm and 59.60 cm respectively) compared to control (Table 1). Further T_4 treatment was on par with T_3 (17.00 cm, 38.00 cm and 58.30 respectively), T_6 (16.50 cm, 36.20 cm and 57.30 cm respectively) and T_{10} (16.80 cm, 37.00 cm and 57.60 cm respectively). Variation in plant height might be due to seed priming and seed treatment with chemicals, growth regulator and biological agents were observed for growth parameters like plant height throughout the crop period. The improvement in plant height by seeds primed with GA_3 might have stimulated the hypocotyl growth as it induces cell elongation has resulted in rapid emergence. Similar results were made by Mohd Mazid (2014) [6] in chickpea in horsegram and blackgram reported that exogenous application of GA_3 to seed increased the hypocotyl size and consequent increase in first node length which is sufficient to positively affect the height. The enhanced plant height may also be due to the improved and faster plant emergence in primed seeds which might have created cooperative competition among the plant for light and resulted in taller plants. The results are in agreement with Rahul and Sachin. (2015) [9] in soybean and Yadav and Singh (2014) [14] in mungbean.

The days required to attain 50 per cent flowering was reduced due to seed priming (Table 1). The GA_3 has induced flowering three days earlier than control. The early flowering may be due to higher endogenous level of GA_3, early completion of vegetative growth and better nourishment of plants. Similar observation in advancement of flowering were also reported by Khairul *et al*. (2015) [4] in chickpea and Thomson *et al*. (2015) [11] in gardenpea. The early flowering with GA_3 treatment may also due to faster emergence more vigorous plant population were observed by Chatterjee and Choudhuri (2012) [2] in cowpea.

The seed priming treatment is known to exert beneficial effect on crop by improving the planting value of seeds. The present investigation confirmed that, increased yield and yield attributing parameters, particularly root nodules per plant and pods per plant are contributed to the improved seed yield. Significantly more number of root nodules per plant was recorded in seeds primed with sodium molybdate @ 500 ppm + seed coating with *T. harzianum* @ 15 g per kg of seed (15.33) (Table 2). Whereas, significantly few root nodules per plant (9.33) was recorded in untreated control (T_{11}). The higher root nodules per plant might be due to the fact that molybdenum is needed primarily on the seed coat in order to enhance nodulation with nitrogen fixing bacteria, which requires molybdenum for the proper functioning of the nitrogen-fixing enzyme nitrogenase, to uphold high rates of biological nitrogen fixation. These evidence are in conformity with the findings of Johnson *et al.* (2005) [3] in chickpea and lentil and Umair *et al*. (2011) [13] in mungbean they reported that seed treated with sodium molybdate enhance the nodulation, nitrogen fixation and nutrient uptake.

Significantly more number of pods per plant was obtained with seeds primed with GA_3 @ 50 ppm + seed coating with *Trichoderma. harzianum* @ 15 g/kg (T_4) (33.00) (Table 2), compared to untreated seeds (28.67). Seeds primed with GA_3 @ 50 ppm + seed coating with *Trichoderma harzianum* @ 15 g per kg of seed was found to be on par with seeds primed with sodium molybdate @ 500 ppm + seed coating with *Trichoderma harzianum* @ 15 g per kg of seed (31.82). The probable reason for more number of pods per plant with GA_3 might be due to juvenility attained through growth regulators and also vigorous growth increased the photosynthetic activity. These evidence are supported by the findings of Mohd Mazid (2014) [6] and Khairul *et al.* (2015) [4], obtained more pods per plant and yield parameters in GA_3 primed chickpea seeds.

The increase in yield with seed treated with mancozeb 50% + carbendazim 25% @ 3 g/ kg can be attributed to increased yield and yield attributing traits such as seed yield per plant (21.00 g), test weight (53.17 g), seed yield (1869 kg/ ha), biomass (2878 kg/ ha) and harvest index (42.12) (Table 2). Whereas, significantly lower values were recorded in control. This increase in seed yield may be due to seed treated with mancozeb 50% + carbendazim 25% @ 3 g/ kg which is more effective in reducing wilt and maintained the more number of plants population per unit area ultimately which increased the seed yield. The results are in conformity with the findings of Astikkumar *et al*. (2013) [1] in greengram. Thus it can be concluded that seed priming of kabuli chickpea seeds with mancozeb 50% + carbendazim 25% @ 3 g/kg seed and carbendazim @ 3 g/kg seed was found to be effective in enhancing seed yield.

Significantly lower per cent of wilt incidence and *Ascocyta* blight were noticed in seed treated with mancozeb 50% + carbendazim 25% @ 3 g/ kg (T_{10}) (1.67% and 4.66% respectively) (Table 3) and it was on par with seeds treated with carbendazim @ 3 g per kg (T_9) (3.00% and 5.33%

respectively). Whereas, highest was recorded in control (T_{11}) (9.33% and 21.33% respectively). Minimization of wilt disease with mancozeb 50% + carbendazim 25% @ 3 g/ kg reported to be effective in reducing the incidence of seed-borne infection. The results are also in conformity with the findings of Morshed *et al*. (2014) [7] reported that, seed treatment with systemic fungicide carbendazim decreases the wilt incidence in chickpea seeds.

Table 1: Effect of priming treatments on plant height at 30 days, 60 days and at harvest and days to 50 per cent flowering in kabuli chickpea

Treatments		Plant height (cm)			Days to 50% flowering
		At 30 DAS	At 60 DAS	At harvest	
T_1:	Seed priming with *Trichoderma harzianum* @ 1.5%	16.00	36.00	57.20	67.00
T_2:	Seed priming with vitavax power @ 0.25%	15.80	35.00	56.30	68.00
T_3:	Seed priming with GA_3 @ 50 ppm	17.00	38.00	58.30	66.00
T_4:	Seed priming with GA_3 @ 50 ppm + seed coating with *T. harzianum* @ 15 g/kg seed	17.80	38.50	59.60	66.00
T_5:	Seed priming with sodium molybdate @ 500 ppm	15.00	33.00	54.50	66.60
T_6:	Seed priming with sodium molybdate @ 500 ppm + seed coating with *T. harzianum* @ 15 g /kg seed	16.50	36.20	57.30	66.00
T_7:	Seed coating with extract of *Lantana camera* @ 10%	14.80	32.00	54.20	67.60
T_8:	Seed hydration for 8 hr	14.00	31.00	54.00	66.80
T_9:	Seed treatment with carbendazim @ 3 g/kg seed	16.00	35.40	56.60	68.50
T_{10}:	Seed treatment with mancozeb 50% + carbendazim 25% @ 3 g/kg seed	16.80	37.00	57.60	67.20
T_{11}:	Untreated control	13.80	29.00	50.00	69.30
S.Em±		0.45	0.50	0.80	0.80
CD @ 5%		1.35	1.40	2.30	2.30

Table 2: Effect of priming treatments on root nodules per plant, number of pods per plant, yield per plant, yield per hectare, harvest index, biomass and 100 seed weight of kabuli chickpea

Treatments		Root nodules/ plant	Number of pods/ plant	Seed yield/ (g/plant)	Seed yield (kg/ha)	Harvest index	Biom-ass (kg)	100 seed weight (g)
T_1:	Seed priming with *T. harzianum* @ 1.5%	10.67	30.33	19.00	1735	40.30	2516	52.50
T_2:	Seed priming with vitavax power @ 0.25%	11.67	30.00	18.90	1675	41.30	2429	52.80
T_3:	Seed priming with GA_3 @ 50 ppm	13.00	30.51	20.10	1777	40.80	2577	53.50
T_4:	Seed priming with GA_3 @ 50 ppm + seed coating with *T. harzianum* @ 15 g/kg seed	13.67	33.00	20.50	1859	39.70	2826	54.70
T_5:	Seed priming with sodium molybdate @ 500 ppm	12.67	29.33	19.00	1654	41.20	2365	53.00
T_6:	Seed priming with sodium molybdate @ 500 ppm + seed coating with *T. harzianum* @ 15 g /kg seed	15.33	31.82	20.20	1839	39.70	2795	54.00
T_7:	Seed coating with extract of *Lantana camera* @ 10%	10.33	30.33	18.50	1756	40.30	2546	52.30
T_8:	Seed hydration for 8 hr	10.00	30.00	18.10	1710	40.80	2480	50.20
T_9:	Seed treatment with carbendazim @ 3 g/kg seed	10.33	31.33	20.30	1797	41.70	2785	50.70
T_{10}:	Seed treatment with mancozeb 50% + carbendazim 25% @ 3 g/kg seed	11.67	31.93	21.00	1869	42.10	2878	53.20
T_{11}:	Untreated control	9.33	28.67	18.00	1611	39.20	2255	50.30
S.Em±		0.59	0.44	0.30	20.75	2.00	37.0	0.40
CD @ 5%		1.74	1.31	0.80	61.22	NS	108	1.60

Table 3: Effect of priming treatments on wilt incidence and *Ascochyta* blight of kabuli chickpea

Treatments		Wilt incidence (%)	*Ascochyta* blight (PDI)
T_1:	Seed priming with *T.harzianum* @ 1.5%	3.20	6.66
T_2:	Seed priming with vitavax power @ 0.25%	4.33	5.66
T_3:	Seed priming with GA_3 @ 50 ppm	5.33	12.66
T_4:	Seed priming with GA_3 @ 50 ppm + seed coating with *T. harzianum* @ 15 g/kg seed	5.00	13.33
T_5:	Seed priming with sodium molybdate @ 500 ppm	6.00	14.00
T_6:	Seed priming with sodium molybdate @ 500 ppm + seed coating with *T. harzianum* @ 15 g /kg seed	4.33	12.66
T_7:	Seed coating with *Lantana camera* extract @ 10%	8.33	14.66
T_8:	Seed hydration for 8 hr	6.33	17.33
T_9:	Seed treatment with carbendazim @ 3 g/kg seed	3.00	5.33
T_{10}:	Seed treatment with mancozeb 50% + carbendazim 25% @ 3 g/kg seed	1.67	4.66
T_{11}:	Untreated control	9.33	21.33
S.Em±		0.45	0.70
CD at 5%		1.35	2.08

Conclusion

Based on the findings of the present study it may be cocluded that among different seed treatment, mancozeb 50% + carbendazim 25% @ 3 g/ kg has been proved as superior for improving growth and yield of kabuli chickpea and considered as effective in disease management strategy.

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