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INTEGRATED NUTRIENT MANAGEMENT AND THEIR APPLICATION IN CHICK PEA (*CICER ARIETINUM* L)

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Abstract:-

A field experiment was conducted to evaluation the effect of mode of application with integrated nutrient management on growth and yield and chickpea, field experiments was carried out in 2013-14 growing seasons. Experimental units were arranged in Factorial Randomized Block Design (RBD) with three replications. The highest amounts of yield and yield components were obtained in Basal application with 80% of inorganic source of fertilizer with seed treatment of PSB. The significant highest seed yield 18.62 q hectare^{-1} was calculated with basal mode of fertilizer application which was 8.38%, 9.46% and 16.73% more seed yield over seed incorporation, broad casting and control. The highest benefit cost ratio 1.93 was also calculated with the same treatment. All of the growth characters viz. plant height, number of primary branches, fresh weight, dry weight at harvest and yield attributes i.e. number of pods plant^{-1}, number of seeds plant^{-1} and number of seeds pod^{-1} were found to be significantly maximum in basal application of 80% of inorganic source with PSB seed treatment.

Keywords: - *Integrated nutrient management, mode of application, PSB, inorganic, chickpea, growth and yield*

INTRODUCTION:

India's productivity in comparison with other countries productivity is low. The reason for low productivity of chickpea in Uttar Pradesh may be due to lack of balance nutrition and their management etc. In Uttar Pradesh, chickpea occupied an area of 5.60 lakh hectares with a production of 3.80 lakh tones with an average productivity of 683 kg ha^{-1}, accounts 6.81% and 5.31% area and production of country, respectively (Agril Statistics at a glance, 2015). Among various factors affecting, proper nourishment of the plant is the key factor for enhancing productivity of chickpea, particularly through organic nutrition, is key natural resource for any pulse production particularly in arid and semi-arid regions, where availability of irrigation water poses a serious threat to the sustainability of crop production. In such agro ecosystem with limited availability of phosphorus, chickpea potentially constitute both a cash crop and a source of N incorporation into the system via organic nitrogen supply. The growing chickpea in crop rotation increased crop productivity and sustainability for the semi-arid region. Maintenance and management of soil fertility is the core of development of sustainable food production systems (Berry *et al,* 2002). Photosynthesis and stomatal conductance are reduced by P deficiency and conversely, increases P increased photosynthesis. *Phosphate Solubilizing Bacteria* (PSB) are also known to increase phosphorus uptake resulting in better growth and higher yield of chickpea plants. The combined inoculation of phosphate solubilizing bacteria has increased nodulation, growth and yield parameters in chickpea (Guidi *et al*, 1994). The bio fertilizers particularly, *PSB* for chickpea plays a crucial role in crop production. It also adds plant nutrients to the soil and organic acids during decomposition which act on the insoluble nutrient reserve in the soil and make them available. Biologically, it provides food for the beneficial soil microorganisms. Method of nourishment and integrated nutrient management offer great promise for exploiting the yield potential of chickpea. Keeping this in view, the field experiment was planned to study the judicious mode application and integrated nutrient management in chickpea.

Materials and Method:

The experiment was conducted at the Brahmanand Mahavidyalaya, Agricultural Research Farm, Post-Rath, District Hamirpur, State-Uttar Pradesh (India) during the winter (Rabi) season of 2013-14. The soil of experimental field was 'parwa' (A category of red soil) with slightly alkaline in reaction (pH 7.6) which was low in available nitrogen (200.83 N_2O kg ha^{-1}), medium in available phosphorus (29.28 P_2O_5 kg ha^{-1}) and high in available potassium (474.16 K_2O kg ha^{1}) and ranging 0.56% organic carbon content (Jackson, 1973). The trial was laid out in factorial randomized block design with three replications having 16 treatment combinations of within recommended dose (Four method of application i.e. control, basal application, seed incorporation and broadcasting and four types of plant nourishment i.e. control, 100% P_2O_5, 80% P_2O_5 + PSB treated seed and 60% P_2O_5 + PSB treated seed), each mode of application were tried with four types of plant nourishment. A uniform dose of nitrogen (40 kg ha^{-1}) through urea as basal application before sowing and recommended dose of P_2O_5 (60 kg ha^{-1}) either pure inorganic source or in combination with *PSB* as supplement of P_2O_5 were applied via DAP in all treatment combinations. Field was prepared and sown the chickpea variety 'Sadabahar' in plots along with recommended package of practices. The field was ploughed with *Desi Plough* and left of 7 days, thereafter, one pre-sowing irrigation was applied to the field. At the right tilth, 4 cross ploughing were done with *Desi Plough*. Others practices viz. interculture, weeding and plant protection measures were applied as need based. PSB (*Phosphate Solubilizing Bacteria*) culture was collected from state agriculture department and chickpea seeds were treated @ 2g kg^{-1} before sowing.

Results and Discussion:

Mode of application of fertilizers and their doses clearly affect when interpreting the data for growth parameters in chickpea. Plant height, number of primary branch, fresh weight and dry weight plant^{-1} all these growth parameter were recorded significantly more in basal method of fertilizer application over seed incorporation, broad casting and control, respectively. Plant height of chickpea was measured 53.22 cm in basal application which was significantly more over other method of fertilizer applications, it was 2.23 cm and 2.32 cm more over seed incorporation and broad casting method of fertilizer applications, respectively may be due to proper root development, proliferation, rapid development of tissues, photosynthesis and maintenance of hydration which ultimately increase the growth of the plant. The control treatment measured least plant height of 48.50 cm (Islam, 2005). Similarly, number of primary branch plant^{-1} were counted maximum with basal method of fertilizer application which was significantly more over rest of the methods. The seed incorporation method was non significantly more over the broad casting method of fertilizer application. Plant fresh and dry weight clearly indicates the real progress of the plant. The highest fresh and dry weight of plant at the harvest time was recorded with basal method of fertilizer application which was significantly more over seed incorporation and broad casting methods of fertilizer application. Both the seed inoculation and broad casting method of fertilizer application were significantly higher over the control. All of the growth parameters were significantly more in basal method of fertilizer application, while the seed incorporation and broad casting were significantly at par amongst each other, the control was recorded lesser growth in this regard may due to the fact that the initial growth of plant was ceased due to non-availability of proper nourishment to the plant (Ved Ram et al 2008).

When we observed the doses of fertilizer, the 80 percent of inorganic source with PSB treated seed were measured maximum growth parameters viz. the plant height 53.77 cm was more 1.00 cm, 3.72 cm and 7.04 cm more over 60 percent of inorganic source with PSB treated seed, 100 percent of inorganic source and control, respectively. Similarly the number of primary branch plant^{-1}, fresh weight plant^{-1} and dry weight plant^{-1} were also recorded highest value with 80% inorganic source with *PSB* treated seed than others doses of fertilizer application. The 60% and 80% of inorganic source with PSB treated seed were significantly at par between each other and were significantly more over 100% of inorganic source and

the control also. It was may be due to growth of plant by using amount of fertilizers which helps to form good photosynthesis and also involved in protein synthesis in the plant (Nawale *et al* 2009).

The effect of mode of application on yield attributes of chickpea was significantly differed among each other. The significantly highest value was recorded with basal application of fertilizer application, maximum number of pods plant^{-1} (38.42), number of seeds plant^{-1} (46.65), number of seeds pod^{-1} (1.50) were counted in basal application over seed incorporation, broad casting and control, respectively. The yield attributing values in seed incorporation and broad casting differed non significantly in this regards. Control method was counted least value in all these parameters of yield attributes. Doses of fertilizers were also significantly differed, the highest value for number of pods plant^{-1}, number of seeds plant^{-1} and number of seeds pod^{-1} were recorded in 80% of inorganic source with *PSB* treated seed, all of the increased result in yield attributes were the result of growth parameters. The control was observed minimum value of yield attributes and 80% of inorganic source and 60% of inorganic source were significantly at par (Rahman *et al* 2009).

The seed yield of chickpea was differed amongst different mode of fertilizer application. Highest seed yield 18.62 q hectare^{-1} was caluclated with basal mode of fertilizer application which was 8.38%, 9.46% and 16.73% more seed yield over seed incorporation, broad casting and control, the highest yield of chickpea was the result of more yield attributes with respective treatment.

The seed incorporation and broad casting method of fertilizer application were differed non significantly among each other. While, the minimum seed yield (15.95 q hectare^{-1}) was calculated with control. Doses of fertilizers were also influenced the seed yield of chickpea, the significantly highest seed yield was with 80% of inorganic sourse with *PSB* treated seed (18.41 q hectare^{-1}) which was 0.38 and 0.79 q hectare^{-1} more over 80% inorganic source with PSB treated seed and 100% inorganic source, respectively (Biswas *et al* 2009).

Benefic cost ratio is the real paramater to decide any input whether it is feasible or not. Hence, it was worked out rupee per hectare on the basis of net plot size. Highest benefit cost ratio 1.93 was calculated in basal application of fertilizer application over seed incorporation (1.80) and broad casting (1.77) due to more grain yield and economic return, the minimum benefit cost value was calculated with control of fertilizer application i.e. 1.62. Doses of fertilizer also affected the benefit cost ratio the maximum value (1.95) was calculated with 80% of inorganic source with *PSB* treated seed and the minimum in the control i.e. 1.64 (Arya *et al* 2007).

Table- 1: Effect of mode of application and fertilizer dose on growth characters of chickpea

Treatments	Height of the plant at harvest (cm)	Number of primary branch plat^{-1} at harvest	Fresh weight plat^{-1} at harvest (g)	Dry weight plat harvest (g) at
Mode of application				
Control (T_0)	48.50	5.14	23.97	22.75
Basal application (T_1)	53.22		25.84	24.73
Seed incorporation (T_2)	50.99	5.61	24.62	23.42
Broad casting (T_3)	50.90	5.57	24.56	23.40
C.D. at 5%	1.39	0.11	0.58	0.58
Doses of fertilizers				
Control (F_0)	46.73	4.49	22.32	20.77
100% P_2O_5 (F_1) (Inorganic source)	50.05	5.70	25.38	22.40
80% P_2O_5 + PSB treated seed (F_2)	53.77	6.15	26.83	23.10
60% P_2O_5 + PSB treated seed (F_3)	52.77	6.06	26.24	23.31
C.D. at 5%	1.39	0.11	0.58	0.58

Table- 2: Effect of mode of application and fertilizer dose on yield attributes of chickpea

Treatments	Number of pods plant^{-1}	Number of seeds plant^{-1}	Number of seeds pod^{-1} (g)	Test weight of 1000 seeds (g)
Mode of application				
Control (T_0)	35.46	42.65	1.25	150.02
Basal application (T_1)	38.42	46.65	1.50	160.61
Seed incorporation (T_2)	36.79	43.65	1.34	156.86
Broad casting (T_3)	36.93	44.06	1.35	157.58
C.D. at 5%	1.01	1.98	0.06	1.75
Doses of fertilizers				
Control (F_0)	29.02	33.83	1.15	150.26
100% P_2O_5 (F_1) (Inorganic source)	37.70	45.25	1.35	157.77
80% P_2O_5 + PSB treated seed (F_2)	40.30	48.74	1.45	161.57
60% P_2O_5 + PSB treated seed (F_3)	39.33	47.20	1.42	160.48
C.D. at 5%	1.01	1.98	0.06	1.75

Table-3: Effect of mode of application and fertilizer dose on seed yield and net profit

Treatments	Seed yield q ha^{-1}	Benefit:Cost Ratio
Mode of application		
Control (T_0)	15.95	1.62
Basal application (T_1)	18.62	1.93
Seed incorporation (T_2)	17.18	1.80
Broad casting (T_3)	17.01	1.77
C.D. at 5%	0.89	
Doses of fertilizers		
Control (F_0)	14.69	1.64
100% P_2O_5 (F_1) (Inorganic source)	17.62	1.82
80% P_2O_5 + PSB treated seed (F_2)	18.41	1.95
60% P_2O_5 + PSB treated seed (F_3)	18.03	1.90
C.D. at 5%	0.89	

Conclusion:

It is clear from the investigation that the basal application of fertilizer application impart much growth to the chickpea plant consequently produced highest yield attributes and finally the yield. 80% of inorganic source with PSB treated seed envisages best fertilizer dose over 60% of inorganic source, 100% inorganic and the control.

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