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RESPONSE OF ISPAGHOL *(PLANTAGO OVATA)* TO DIFFERENT LEVELS OF PHOSPHORUS FERTILIZER UNDER THE AGRO-CLIMATIC CONDITIONS OF CHOLISTAN, PAKISTAN

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ABSTRACT

A field experiment was conducted at the Cholistan Farm of Arid Zone Research Institute, Bahawalpur during Rabi 2005-2006, to observe the effect of different levels of Phosphorus on the growth and yield of Ispaghol. Five different levels of Phosphorus (Tripple Super Phosphate, TSP) i.e. 25, 50, 75, 100 kg ha^{-1} and Control were tried. Seed yield varied significantly in the concentration of phosphorus applied. Out of all the treatments applied, 100 kg ha^{-1} 'P' showed excellent results with the seed yield of 915.5 kg ha^{-1} and statistically the lowest seed yield of 591.0 kg ha^{-1} was obtained in case of control (in which 'P' fertilizer was not applied). It is believed that such an increase in the yield was mainly due to the factors like an increase in the tillers per plant, capsules per plant and seed weight.

Key words: Ispaghol, Phosphorus, Growth, Seed yield, Soil type, Cholistan.

INTRODUCTION

Ispaghol (*Plantago ovata*) is an important and widely used medicinal plant; its husk has the property of absorbing and retaining water therefore, it works as an anti-diarrhoeal drug. It is beneficial in chronic dysenteries of amoebic and bacillary origin. It is also used for treating constipation and intestinal disorders because it works as calorie-free fiber food, promoting regular bowels movement. The seed has cooling and demulcent effect and is used in Ayurvedic, Unanai and Allopathic system of Medicine. Other remarkable properties of the Ispaghol seed are sweet, astringent, referingent, emollient, mucilaginous, diuretic, laxative, anti-inflammatory, dysenteric, expectorant, aphrodisiac, roborant and tonic. Moreover, both the seed and the husk are used to cure inflammations of the mucous membranes of gastro-intestinal and genito-urinary tracts. In addition to these medicinal uses, it is also being used in calico printing and dying, in the ice cream industry as a stabilizer, in confectionery and cosmetic industries. The seed with out husk, contains about 17-19% protein, is also used as cattle feed.

Fig. 1. Experimental crop of Ispaghol grown at Cholistan Farm.

Ispaghol grows well on light soils. Heavy soils and those with poor drainage are not conducive to the good growth of this crop. A silty loam soil having pH 4.7-7.7 with low nitrogen and moisture contents is reported to be ideal for its better growth. It thrives well in warm temperate region. It requires cool and dry weather and sown in winter months. Its major growing area in Pakistan is sandy soils of Punjab in the regions of Hasilpur and Khairpur.

Phosphorus is considered to be an essential nutrient for plant growth and development. It is an integral part of nucleic acid and is essential for cellular respiration and the metabolic activity. It plays a vital role for increasing tillering, promoting flowering, seed development, seed yield and its quality. A few studies have been carried out in India and other parts of the world (Patel and Sadaria, 1996). Keeping in view the role and importance of phosphorus fertilizer for plant growth and yield, the present study was planned with an aim to find out the optimum level of TSP fertilizer which will contribute in obtaining an improved yield of Ispaghol under the agro-climatic conditions of Cholistan.

MATERIALS AND METHODS

The experiment was conducted on sandy soil at the Cholistan Farm of Arid Zone Research Institute, Bahawalpur. Five different levels of Phosphorus (TSP) i.e. 25, 50, 75, 100 kg $ha^{-1}$and control were compared. The experiment was planned in accordance with the Randomized Complete Block Deign (RCBD) with three replicates. Plot size was kept 3 x 5 m^2, while row to row distance was kept as 30 cm. Complete dose of phosphorous was applied at the time of sowing and all other agronomic practices were adopted uniformly in all the cases. Data on various pre-determined parameters such as plant height, tillers/plant, capsules/plant, capsule length, branches/plant, 1000-seed weight and seed yield was recorded and analyzed statistically by Fisher's analysis of variance technique. Least significance difference (LSD) Test at 5% was employed to compare different treatment means (Steel and Torrie, 1980).

RESULTS AND DISCUSSIONS

The data regarding Physico-chemical composition of experimental soil of the site before sowing is given below (Table 1). The soil was loam in texture and deficient in available P and available N. The soil contained sufficient amount of available K (290 ppm). The soil pH was recorded to be 7.9.

Table 1. Physico-Chemical properties of soil of experimental site before sowing (soil depth 0-15 cm).

Texture class	Loam Soil
Soil pH	7.90
Organic matter (%)	**0.62**
Available P (ppm)	**7.10**
Available K (ppm)	**290**
Soil EC (ds/m)	2.10
Available Zn (ppm)	0.90

It was found that the parameters like plant height, branches/plant and capsule length were not influenced significantly by different phosphorus levels which have indicated that phosphorous had no direct affect on such growth parameters. However, plants with maximum height of 28.1 cm were found in the plots where phosphorus was used @ 75 kg ha^{-1}. Maximum branches/plant (20.4) and capsule length (2.71) was recorded from plots which were treated with phosphorus @ 100 kg ha^{-1}(Table-2).

Table 2. Response of Ispaghol to different levels of 'P' fertilizer.

Phosphorus levels (kg ha^{-1})	**Plant height (cm)**	**Tillers/ plant**	**Capsules/ plant**	**Capsule length (cm)**	**Branches / plant**	**1000- seed weight (gm)**	**Seed Yield (kg ha^{-1})**
Control	25.4	1.80 b	13.13 c	2.36	14.1	3.27 b	591.0 e
25	26.5	1.93 b	17.33 b	2.47	18.7	3.37 b	626.3 d
50	27.8	2.50 a	17.27 b	2.58	19.4	3.46 b	731.5 c
75	28.1	2.53 a	18.07 ab	2.65	18.6	3.50 b	756.2 b
100	27.9	2.67 a	19.33 a	2.71	20.4	4.10 a	915.5 a

LSD (0.05)	NS	0.27	1.76	NS	NS	0.29	18.4

Tillers per plant is an important yield component as an increase in the number of tillers produced more capsules and ultimately the higher yield. The analyzed data indicated that tillers per plant showed significant differences among different 'P' levels. The highest tillers per plant (2.67) were obtained in case of 100 kg ha^{-1} 'P'. On the contrary, the lowest tillers per plant (1.80) were recorded in the plots where no Phosphorus was applied (Table-2).These results are in line with the findings of Patel and Sadaria (1996), who have also reported that increasing level of Phosphorus increases the tillering capacity of the Ispaghol plant.

A capsule per plant is another important yield contributing factor. The results have revealed that capsules per plant differed significantly among various 'P' levels. The highest number of capsules per plant (19.33) were obtained from the plots where maximum 'P' level of 100 kg ha^{-1} was applied. It was followed by the plots where 'P' was applied @ 75 kg ha^{-1}. On the other hand minimum number of capsules per plant (13.13) were obtained from control plots where no phosphorous was applied (Table-2). The findings of this study are quite similar to those indicated by Patel and Patel (1996) and Parihar and Singh (1995) wherein the number of capsules per plant have shown a directly proportional relationship with the level of Phosphorus applied in each case.

1000-seed weight had a fairly direct influence on the seed yield. The present study has shown that there are significant differences among the results of different levels of Phosphorous. Maximum 1000-seed weight of 4.10 gm was achieved in case of 100 kg ha^{-1} 'P' and minimum 1000-seed weight of 3.27 gm was recorded in the plots where no 'P' was used (Table-2).These results are in accordance with the findings of Czarnecki and Golcz (1985), who have reported similar results in a study on the influence of mineral fertilization on the yield of Ispaghol.

The seed yield is the ultimate outcome and is a function of cumulative effect of various yield components. The results have revealed that seed yield varied significantly among various levels of phosphorus. Out of all the Phosphorus levels compared in this trial, the 'P' level of 100 kg ha^{-1} produced significantly the highest seed yield of 915.5 kg ha^{-1} while the minimum seed yield of 591.0 kg ha^{-1} was obtained in case of control where no 'P' fertilizer was applied. These results are also similar to those of Intodia and Tomar (1998) who have reported that phosphorus application had a significant effect on the final yield of Ispaghol. These findings are also in conformity with the observations made by Parihar and Singh (1995) and Singh and Chouhan (1994). It can be concluded that the application of Phosphorus at 100 kg ha^{-1} may give an improved yield of Ispaghol.

REFERENCES

Iodia, S. K. and O. P. Tomar. (1998). Response of psyllium (*Plantago ovata*) genotypes to nitrogen and phosphorus on heavy soil. Journal of Medicinal and Aromatic Plant Sciences, 20(4): 1042-1044.

Patel, B. S. and J. C. Patel. (1996). Response of blond psyllium (*Plantago ovata*) to irrigation, nitrogen and phosphorus. Indian Journal of Agronomy, 41(2): 311-314.

Patel, B. S. and S. G. Sadaria. (1996). Influence of irrigation, nitrogen and phosphorus on yield, nutrient uptake and water-use efficiency of blond psyllium (*Plantago ovata*). Indian Journal of Agronomy, 41(1): 136-139.

Parihar, G. N. and R. Singh. (1995). Response of psyllium (*Plantago ovata*) to nitrogen and phosphorus fertilization. Indian Journal of Agronomy, 40(3): 529-531.

Singh, I. and G. S. Chouhan. (1994). Effect of mixtalol and different combinations of nitrogen and phosphorus fertilizer on growth and yield of blond psyllium (*Plantago ovata*). Indian Journal of Agronom, 39(4): 711-712.

Czarnecki, M. and L. Golcz. (1985). Influence of mineral fertilization on yield and nutrient absorption in *Plantago psyllium L.* Herba Polonica, 31(3-4): 167-174.

Steel, R.G.D. and J.H. Torrie. (1984). Principles and procedures of statistics. McGraw Hill Book Co. Inc. Singapore, pp: 172-174.

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