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THE EFFECT OF NITROGEN AND PHOSPHORUS ON THE NUMBER OF TILLERS PER PLANT IN CASE OF ISABGOL *(PLANTAGO OVATA* LINN.)

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ABSTRACT

The present study was carried out to evaluate the effect of nitrogen and phosphorus on the number of tillers per plant in case of Isabgol *(Plantago ovata* Linn.). The experiment consisting of 9 treatments with three levels of nitrogen [0, 25 kg/ha (12.5 as basal dose & 12.5 as aerial dose) and 50 kg/ha (25 kg N/ha as basal dose & 25 kg/ha as aerial dose) and three level of P /ha (0, 25, and 50 kg N/ha) as basal dose] and their different combination with Line sowing method were conducted in Randomized Block Design.Different levels of nitrogen, phosphorous and their combination significantly influenced the number of tillers/ plant. A close perusal of number of tillers/ plant revealed that maximum number of tillers/plant was observed in treatmentT_4 (5.00 & 5.33) at 50 DAS, (9.33) at 80 DAS, (9.66 & 10.00) at 110 DAS and the minimum number of tillers/ plant in treatment T_0 (2.00 & 2.33) at 50 DAS, (3.66&4.00) at 80 DAS, (5.00&4.33)at 110 DAS in both sets of experiments conducted in two years.

Keywords:*Plantago ovata,* Isabgol, Nitrogen, Phosphorus, Tillers

INTRODUCTION

For centuries, the forests have been the source of herbs and medicinal plantsMedicinal plants which are rich in secondary metabolites, form the main base for the manufacture of drugs of Indian Systems of Medicine (Ayurveda, Unani, Siddha) and Homeopathy. The ancient Indian Systems of Medicine (ISM) is predominantly a plant based *Materia medica* making use of most of our native plants. Medicinal plants may constitute an important area for rural development. Creating greater general awareness about cultivation, conservation and utilization of naturally available medicinalplant resources amongst the rural masses for economic value of these plants will result inwise use of this heritage.

Most of the medicinal plants can subsist under stress conditions and are thus suited even for rain fed agriculture. The expansion in the cultivation of medicinal plants on farmer's land or private land, wasteland and in agro forestry systems will be helpful in meeting the requirements of herbal drug industry. This will also provide an additional source of employment and income to the unemployed rural population. Besides this, we shall secure patent for the agro-practices and drugs and formulations derived from our native medicinal plans. Thus research works for development and cultivation of medicinal plants can develop resource for our medicinal plants.

Isabgol (*Plantago ovata* Forsk) is one of the important and export potential medicinal crop in India. The name Isabgol is derived from two Persian words "Isap" and "Ghal" meaning a horse ear, referring to the characteristics

shape of its seeds. The genus Plantago comprises 200 species of which 10 occur in India. Among the latter, *Plantago ovata* (isabgol) is valued for its seeds and husk which have been used as laxative, that is particularly beneficial in habitual constipation, chronic diarrhea and dysentery for centuries all over the world. It is a plant of West Asian origin and is believed to have been introduced into India during Muslim settlement in the middle age.

India continues to rank first in the isabgol production, and trade in the world market. At present, Gujarat, Madhya Pradesh and parts of Rajasthan, especially its Malwa tract and northern belt, are the major *P.ovata* growing areas in India. is out of these Gujarat is the leading state in the cultivation of Isabgol in India covers about an area of 16,000-20,000 hectare of land and the total area under the cultivation of Isabgol 33,600 hectare. Another but minor source of seed and seed husk is *P. psyllium* This species was earlier cultivated in France; presently France imports sizeable quantity of isabgol from India. Other species of the genus, including *P.major, P.lanceolata, P.pumilla, P. coronopus, P.argentia* and *P. lagopus* produce small quantities of mucilage around their seeds. However, none of these fined use in pharmaceutical industry.

Plantago ovata is an annual herb, which attains a height of 30-40 cm. The stem is wholly underground and covered with fine hairs. Isabagol has been grown in a wide range of agro-climatic conditions, but it requires cool and dry weather conditions for growth and development of plants. The high rainfall areas are not suited for its cultivation.Infact cloudy weather, mildew or even light showers causes heavy shedding of flowers and seeds and consequently inflict heavy losses in seed yield.

The present study was conductedwas conducted to investigate the effect of nitrogen and phosphorus on the number of tillers per plant in case of Isabgol *(Plantago ovata* Linn.). A tiller is a shoot that arises from the base of grass plant. Tillering begins around 40 days after planting and can last upto 120 days. It gives the crop the necessary number of stalks required for a good production.

MATERIAL AND METHODS

Experimental site: The present investigation was conducted at the research farm of Department of Botany, Baring Union Christian College, Batala during winter season for almost one year.

Figure 1. Research Plot at Baring Union Christian College, Batala, Punjab, India.

Climate and weather: Batala is situated at an elevation of 249 meters above the mean sea level, at 31.820N latitude and 75.20E longitude has a tropical and sub-tropical climate with extremes of summer and winter. During the winter months, especially during December and January the temperature drops

at low as 4-20C, while during summer, the temperature reaches more than 450C. The average rainfall is about 100 cm with maximum during July to September with a few occasional showers during the winter months.

Soil and soil sampling: In order to study the physical and chemical analysis of soil, a composite soil sample was taken from 10-30 cm soil depth with the help of soil auger. The soil samples were mixed together, air-dried, finely powered and again mixed. A representative soil sample of 5 gm for each analysis was then drawn and subjected to mechanical and chemical analysis.

Mechanical analysis: The mechanical analysis was done by Bouyoucus hydrometer method. The result of the analysis is given in table 1.

Table 1. Physical analysis of soil.

Components	Percentage
Sand Silt Clay	60.60 19.30 20.10
Textural class	Sandy loam

Chemical analysis: The chemical analysis was done for nitrogen phosphorus, potassium, pH, EC and organic carbon. The result of the analysis has been presented in the following table 2.

Table 2. Chemical analysis of soil.

Components	Quantity	Method employed
Organic carbon %	0.28	Walkley and black (1956)
Nitrogen Kg/ha	210	Alkaline permanganates method (Subbaiah and Asija, 1956)
Phosphorus (P2O5) kg/ha	18.50	Olsen's Colorimetric method (Olsen et al. 1954)
Potassium (K2O5) Kg/ha	240	Flame Photometer (Toth and Princ 1949)
pH	7.3	Digital electronic pH meter.
EC (dSm-1)	0.32	Conductivity meter (Systronics)

It is evident from the above table that the soil of the experimental plot was sandy loam in texture, poor in nitrogen, comparatively rich in phosphorus and potash with slightly alkaline in nature.

Cropping history of the experimental field: Before the commencement of the present experiment the field was exclusively utilized for the cultivation of flower crops. The cropping history of the field for the proceeding three years has been presented in table 3.

Table 3. Cropping history of the field.

Summer Season	Rainy Season	Winter Season
Fallow	Fallow	Aster
Fallow	Fallow	Marigold
Fallow	Fallow	Dahlia

Preparation of experimental field: The following pre-sowing and post-sowing operations were carried out for the preparation of field before sowing of the seeds.

Table 4. Pre-sowing operation.

Operation	Remarks
Ploughing of field	By Tractor
Demarcation of area and layout of experimental field	By manual labour
Light irrigation	By manual labour
Application of manure	By manual labour
Weeding and leveling	By manual labour

Application of fertilizers	By manual labour
Sowing of seeds	By manual labour

Table 5. Post Planting Operations.

Operation	Remarks
Sowing of seeds	By Tractor
Light irrigation	By manual labour
Thinning and spacing	By manual labour
Irrigation	By manual labour
Weeding	By manual labour
Application of remaining dose of urea	By manual labour
Spraying of chlorophyriphos @ 0.2%	By manual labour
Irrigation	By manual labour
Irrigation	By manual labour
Weeding	By manual labour
Spraying of chlorophyriphos @ 0.2%	By manual labour
Irrigation	By manual labour
Harvesting	By manual labour

Source of planting material : The seed of Isabgol *(Plantago ovate* Forsk*)* cv. Niharika were obtained from Central institute of Medicinal and aromatic plants, Lucknow

Experimental details:

Nitrogen (N) levels (Urea - 46 %)

N_0 - Control

N_1 - 25 Kg/ha (12.5 kg as basal dose + 12.5 as aerial dose after 30-40 DAS)

N_2 - 50 Kg/ha (25 kg as basal dose + 25 as aerial dose after 30-40 DAS)

Phosphorous (P) levels (Single Super Phosphate - 16 %)

P_0 - Control

P_1 - 25 Kg/ha

P_2 - 50 Kg/ha

Table 6. Treatment combination used in the present study.

Notation	Treatment
$T_0(N_0P_0)$	Control
$T_1(N_0P_1)$	Control + 25 Kg P_2O_5/ha
$T_2(N_0P_2)$	Control + 50 Kg P_2O_5/ha
$T_3(N_1P_0)$	25 Kg N/ha + Control
$T_4(N_1P_1)$	25 Kg N/ha + 25 Kg P_2O_5/ha
$T_5(N_1P_2)$	25 Kg N/ha + 50 Kg P_2O_5/ha
$T_6(N_2P_0)$	50 Kg N/ha + Control
$T_7(N_2P_1)$	50 Kg N/ha + 25 Kg P_2O_5/ha
$T_8(N_2P_2)$	50 Kg N/ha+ 50 Kg P_2O_5/ha

Statistical analysis: The observed data were tabulated and analyzed statistically using analysis of variance technique of (Fisher, 1950) for testing significance. The critical difference was estimated at 5% level of probability.

RESULTS AND DISCUSSION

The observations related to growth and yield of *Plantago ovata* crop grown in the period of study were recorded, tabulated and presented under the following heads for convenience in understanding and drawing valid conclusion

Number of tillers per plant: The number of tillers per plant was observed during the vegetative growth of plant at every 40 days

interval. The observations of number of tillers per plant as affected by different levels of nitrogen and methods are tabulated in table. Results are presented in table 6 and figure 2.

Number of tillers at 50 DAS (Days After Sowing): Study of recorded data depicted that number of tillers per plant 50 DAS was found to be significant for Isabgol during both the years separately. However highest number of tillers/plant was exhibited by treatment T_4 & T_5 (5),followed by treatment T_6 (4.33), T_7 & T_8 (4.00), T_3, (3.60) T_2 &T_1(3.00) andT_0 control(2.00)in first year (2005-06) and in the second year (2006-2007) same pattern of growth is followed i.e. maximum number of tillers/plant was observed in the treatment T_4 & T_5 (5.33),followed by treatment T_6 (4.66), T_7& T_8 (4.00), T_3 (3.60), T_2& T_1 (2.66) , andT_0 control(2.33). Whereas, minimum number of tillers/Plant was observed by control in both the years (2.00 and 2.33) respectively.

It was observed that with the continuous increase of Nitrogen and Phosphorous up to 12.5 kg/ha Nitrogen and 25kg/ha which were applied at sowing time + half of the Nitrogen (12.5 kg/ha) applied after 30 - 40 DAS gave maximum number of tillers/plant. Any further increasing of Nitrogen and Phosphorous decreased the number of tillers/plant.

Number of tillers at 80 DAS:A close perusal of data depicted that number of tillers/plant at 80 DAS was found to be significant for Isabgol. However, highest number of tillers/plant was exhibited by treatment T_4(9.33) followed by treatment T_5 (9),T_6 (8.33), T_7 & T_8 (7.66), T_3, (7.33) T_2 (6),T_1(5.33) andT_0 control(3.66)in first year (2005-06) and in the second year (2006-2007) same pattern of growth is followed i.e. maximum number of tillers/plant was observed in the treatment T_4 (9.33)followed by treatment T_5(9.00), T_6& T_7(8.00), T_8(7.33), T_3(7.00), T_2(6.66),T_1(5.66) andT_0 control(4.00).

Again it was observed that with the continuous increase of Nitrogen and Phosphorous up to 12.5 kg/ha Nitrogen and 25kg/ha which were applied at sowing time + half of the Nitrogen (12.5 kg/ha) applied after 30 - 40 DAS gave maximum number of tillers/plant. Any further increasing of Nitrogen and Phosphorous decreased the number of tillers/plant.

Number of tillers at 110 DAS:A close perusal of data depicted that number of tillers/plant at 110 DAS was found to be significant for Isabgol. However, highest number of tillers/plant was exhibited by treatment T_4(9.66) followed by treatment T_5 (9.33),T_6 (8.66), T_7 & T_8 (8.00), T_3, (7.66) T_2 (7.00),T_1(6.66) andT_0 control(5.00)in first year (2005-06) and in the second year (2006-2007) same pattern of growth is followed i.e. maximum number of tillers/plant was observed in the treatment T_4 (10.00)followed by treatment T_5(9.00),T_6(9.00), T_7(8.66), T_8(8.00), T_3(8.00), T_2(7.00), T_1(6.00) andT_0 control(4.33).

Again a similar trend was observed that with the continuous increase of Nitrogen and Phosphorous up to 12.5 kg/ha Nitrogen and 25kg/ha which were applied at sowing time + half of the Nitrogen (12.5 kg/ha) applied after 30 - 40 DAS gave maximum number of tillers/plant. Any further increasing of Nitrogen and Phosphorous decreased the number of tillers/plant.The increase in number of tillers per plant was due to maximum growth of plant, stimulated through the supply of adequate amount of fertilizer (nitrogen). The observation recorded in present findings has also been supported by Swarupa *et al.* (2003).Ramesh et al. (1989) have studied the effect of nitrogen on number of spikes per plant of Isabgol and found that the number of spikes per plant increased with the application of 75 kg N/ha. Singh et al. (1994) reported that the application of 60 kg N/ha significantly increases the number of spikes per plant. Kulmi (1998) reported that the application of nitrogen up to 40 kg/ha increased the number

of tillers and spikes per plant. Mann and Vyas (2001) conducted a field experiment and concluded that the highest number of spike per plant was obtained with the application of 45 kg N/ha. Bist et al. (2001) reported that the application of 40 kg N/ha increases the number of tillers per plant. Sharma et al. (2003) observed that the number of spikes per plant are higher in line sowing with the application of 45 kg N/ha. Swarupa et al. (2003) conducted an experiment with 4 levels of nitrogen (0,25.50 and 75 kg/ha). Nitrogen at 50 kg/ha gives the highest number of tillers and spikes per plant.

Table 6. Effect of Nitrogen, Phosphorous and their interaction on number of tillers per plant of Isabgol (*Plantago ovata*) at 50, 80, 110 DAS. (Days After Sowing).

Treatment	50 DAS		80 DAS		110 DAS	
	First Year	Second Year	First Year	Second Year	First Year	Second Year
T_0(Control)	2.00	2.33	3.66	4.00	5.00	4.33
T_1	3.00	2.66	5.33	5.66	6.66	6.00
T_2	3.00	2.66	6.00	6.66	7.00	7.00
T_3	3.60	3.60	7.33	7.00	7.66	8.00
T_4	5.00	5.33	9.33	9.33	9.66	10.00
T_5	5.00	5.33	9.00	9.00	9.33	9.00
T_6	4.33	4.66	8.33	8.00	8.66	9.00
T_7	4.00	4.00	7.66	8.00	8.00	8.66
T_8	4.00	4.00	7.66	7.33	8.00	8.00
F-test	S	S	S	S	S	S
S.Ed(±)	0.288675	0.509175	0.573326	0.612372	0.495348	0.561083

C.D.(p=0.05)	0.747668	1.318763	1.484916	1.586044	1.282953	1.453206

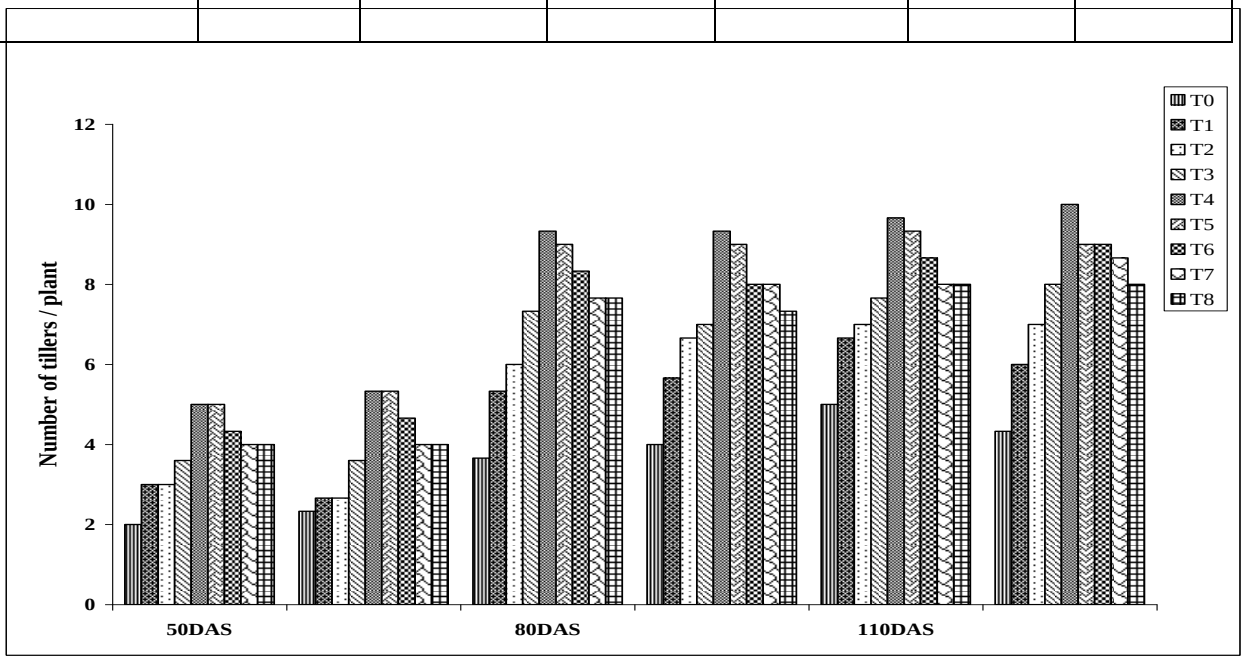

Figure 2. Effect of Nitrogen, Phosphorous and their interaction on number of tillers per plant of Isabgol (*Plantago ovata*) at 50, 80, 110 DAS.

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