Productivity of grasspea (*Lathyrus sativus* L.) under different levels of phosphorus and foliar spray of molybdenum

R.K. Sarkar[1], B. Biswas[2] and G.C. Malik[1]

1. Department of Agronomy, University College of Agriculture, Calcutta University, Calcutta, West Bengal – 700 019, India

2. Zonal Adaptive Research Station, Government of West Bengal, Krishnagar, West Bengal – 741 101, India

Introduction

Grasspea (*Lathyrus sativus* L.) is one of the important food legumes in many countries of Southern Europe, North Africa and Asia Minor (1). It is grown in dry and warm regions due to its potential among grain legumes to tolerate dry and unfavourable conditions (4). Being drought and flood tolerant, with a high seed protein content and suitability for soil amelioration, grasspea accounts for about 5% of total area in India under pulses and 4% of production. It is a significant crop of the Indo-Gangetic plains grown mainly on residual moisture as a crop succeeding another crop. Adoption of promising varieties and suitable crop management practices are important factors for exploring yield potential of grasspea. Phosphorus is the most essential nutrient for increasing pulse productivity (3). Molybdenum is important in the nutrition of legumes as it is essential for the activity of the enzyme nitrogenase (5). Hence an experiment was undertaken to study the response of grasspea varieties to phosphorus and molybdenum in a rainfed alluvial soil (entisol).

Material and Methods

The field experiment was conducted during the winter season of 1998/99, 1999/2000 and 2000/01 at the Zonal Adaptive Research Station, Krishnagar, West Bengal, India (88.31°E, 23.24°N and 15 m above sea level). The soil was a Gangetic alluvial (entisol), having 0.53% organic carbon, 26 kg/ha available P_2O_5, 148 kg/ha available K_2O, with pH 7.5. The treatments consisted of 2 grasspea varieties viz. Nirmal and Biol-212; 4 phosphorus levels (0, 20, 40 and 60 kg/ha of P_2O_5); 2 levels of foliar spray of molybdenum (no foliar spray and 0.05% Mo) were tested in a factorial design with 3 replications in winter rice fallow land. Treatments allotted to plots were fixed for 3 seasons on the same site. Seeds were treated with rhizobial inoculant (*Rhizobium leguminosarum*) before sowing. The crop was sown during the second fortnight of November each year after harvest of winter rice. A basal dose of 20 kg/ha N and 40 kg/ha K_2O, along with P_2O_5 as per treatment were applied at sowing. Dilute solutions of 0.05% Mo were applied as ammonium molybdate at the rate of 800 L/ha of water as foliar spray during the preflowering stage. Nodulation was studied with 2 plants from each plot at post flowering stage. Data were recorded on 10 randomly selected plants from each plot for yield attributes, and yields were computed after harvest of the crop from each plot. A total rainfall of 64.5, 56.0 and 49.5 mm was recorded in the winter season of 1998/99, 1999/2000 and 2000/01, respectively.

Results

In general, the yield level was higher in 1999/2000 than in 1998/99 and 2000/01.

The number as well as dry weight of nodules/plant were significantly higher in variety Nirmal. The variety Nirmal outyielded Biol-212 during all the years and in pooled data (Table 1). The number of nodules/plant, and dry weight significantly increased with the increasing level of P up to 60 kg/ha P_2O_5. The yield attributes and seed yield increased with the increase in each successive level of P up to 60 kg/ha P_2O_5. There was a 31.5% mean increase in seed yield with 60 kg/ha P_2O_5 over 0 P application.

Foliar spray of 0.05% Mo increased number of nodules/plant, dry weight of nodules and also improved yield attributes and seed yield over no Mo spray. Such a foliar spray of Mo resulted in 24.0% higher seed yield over the control in the pooled data.

Table 1. Nodulation, yield attributes and seed yield of two grasspea varieties under P fertilisation and foliar spray of Mo (pooled data for three years: 1998/99, 1999/2000 and 2000/01).

Treatment	Nodules /plant	Dry weight nodules (mg/plant)	Pods/ plant	Pod length (cm)	Seeds/ pod	1000 seed weight (g)	Seed yield (t/ha) 1998/ 99	1999/ 2000	2000/ 01	Pooled
Variety:										
Nirmal	9.42	57.04	26.08	3.62	3.06	65.81	0.91	1.38	0.93	1.07
Biol-212	8.73	48.85	23.71	3.05	3.05	70.92	0.86	1.24	0.82	0.98
LSD (P<0.05)	0.60	3.52	1.69	0.21	NS	2.00	0.04	0.05	0.09	0.05
Phosphorus (P_2O_5 kg/ha)										
0	6.60	28.92	21.18	3.16	2.78	66.27	0.77	1.09	0.76	0.76
20	6.85	45.66	23.77	3.26	3.05	68.20	0.83	1.22	0.82	0.82
40	6.90	61.33	25.70	3.47	3.11	69.00	0.95	1.41	0.92	0.92
60	7.00	75.89	28.93	3.48	3.25	69.93	0.99	1.54	1.00	1.00
LSD (P<0.05)	0.28	4.99	2.31	0.25	0.27	2.80	0.05	0.07	0.13	0.06
Molybdenum										
0	8.12	44.54	23.57	3.59	2.97	68.23	0.78	1.17	0.80	0.91
0.05% Mo	10.01	61.06	26.21	3.08	3.13	68.50	0.99	1.46	0.95	1.14
LSD (P<0.05)	0.60	3.53	1.64	0.21	NS	NS	0.04	0.05	0.09	0.07

Discussion

Higher yield of grasspea in 1999/2000 is attributed to climatic factors in this year. Grasspea variety Nirmal performed better than Biol-212, the higher seed yield for Nirmal could be attributed to efficient nodulation for N- fixation and its assimilation.

Application of P increased the yield attributes and showed a marked increase in yield of grasspea. The improvement in yield attributes and yield by P application may be attributed to profuse nodulation, leading to increased N-fixation which in turn had positive effect on photosynthetic organs and rate [(7)]. Improvement in number and dry weight of nodules/plant due to foliar spray of Mo may be ascribed to the significant increase in nitrogenase activity by Mo. Foliar spray of 0.05% Mo resulted in marked increase in seed yield and overall improvement in yield attributes. The increase in yield by Mo could be attributed to greater nitrogenase activity which led to increases in yield attributes and consequent higher yields. Higher seed yield in grasspea with foliar spray of Mo might possibly be due to greater assimilation of carbohydrate and protein synthesis as Mo acts in N-assimilation [(2)] and increases intensity of photosynthesis [(6)].

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