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ROLE OF STARTER NITROGEN AND TIME OF PHOSPHATE APPLICATION IN MAXIMIZING BERSEEM PRODUCTION

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A field experiment on an alkaline calcareous sandy clay loam soil classified as Camborthid, was conducted in order to assess the effect on berseem of 50, 100 and 150 kg P_2O_5/ha rates of phosphorus application with or without 30 kg/ha starter nitrogen and to compare application of 100 and 150 kg P_2O_5/ha rates at sowing with their application in two equal splits, one half at sowing and one half at first cutting. The data revealed a positive effect on fodder yield as well as phosphorus content of fodder by the application of phosphorus as single superphosphate. Application of 30 kg/ha starter nitrogen along with 100 kg P_2O_5/ha was found to be superior to 100 kg P_2O_5/ha alone for the fodder yield of berseem. Application of 100 and 150 kg P_2O_5/ha at sowing produced similar fodder yield as the same amounts applied by two equal splits along with starter nitrogen.

INTRODUCTION

Berseem (Egyptian clover) is an important rabi (winter) fodder crop of Pakistan. It is high yielding and provides good quality fodder throughout the winter and spring season. Being a leguminous crop, its role in crop rotation is quite significant for the maintenance and improvement of soil fertility (Parr and Base, 1944 and Rao *et al.*, 1954). Furthermore the crop residues are a source of organic matter which favourably effects the physical condition of the soil (Biswas *et al.*, 1963).

Considerable work in the past has established that being a legume crop its requirement of nitrogen is nominal and that too is during early stages for the establishment of seedlings, whereas the need for phosphorus is pronounced (Siddiki and Naqvi, 1965; Wahhab. 1960 and Sarwar, 1976).

The soil texture in Pakistan generally varies from sandy loam to clay loam. Such a soil textural condition may permit, to a few cm depth, adequate downward movement of surface applied phosphorus with irrigation water

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(Wahhab, 1960). It is likely, therefore, that topdress phosphorus may be more efficiently utilized with least fixation by the fully developed root system of crop in contrast to the total application at sowing.

Taking into consideration these points it was contemplated to study in a field experiment, the effect of starter nitrogen, phosphorus rate and its time of application on fodder yield and quality of berseem.

MATERIALS AND METHODS

A field experiment was conducted on a normal productive sandy clay loam calcareous soil classified as Camborthid, with pH of 8.14, organic matter and available P_2O_5 contents, respectively of 0.64% and 14.31 ppm in the Ap horizon. Phosphorus as single superphosphate (SSP) was tested at the rate of 50, 100 and 150 kg P_2O_5/ha along with 30 kg/ha urea nitrogen as a starter dose. In addition, 100 and 150 kg P_2O_5/ha were split in two equal halves, one half being applied at sowing along with 30 kg N/ha and the other half applied after first cutting followed immediately by irrigation water. Furthermore, 100 and 150 kg P_2O_5/ha were applied at sowing without starter nitrogen in order to evaluate the role of starter nitrogen. In all, there were eight treatments including control which did not receive any fertilizer.

The experiment was laid out in Randomized Complete Block Design with four replications. Berseem crop was planted on 12-10-1978 according to the conventional method of flood irrigation followed by the broadcast of seed in standing water agitated by tree twigs in order to cover the seed by a thin layer of soil. In all, five cuttings were taken and green fodder yield recorded. Plant samples were composited plotwise, chopped, oven dried, ground and stored for chemical analysis. Nitrogen and phosphorus were determined in the plant samples by Micro-kjeldhal and Colourimetric methods, respectively.

RESULTS AND DISCUSSION

Fodder yield of berseem

It is evident from the data on fresh fodder yield of berseem for five cuttings that phosphorus application had a positive effect in increasing the yield (Table 1). Increments in phosphorus application caused a corresponding increase in the fodder yield. Split application of phosphorus was found to be slightly superior to application of total amount at sowing. The fodder yield data conclusively suggest the essentiality of phosphorus application for a

Table 1. *Effect of starter nitrogen and time of phosphate application on the mean fodder yield of berseem for various cuttings with dates.*

Treatments $N-P_2O_5$ (kg/ha)	I Cutting 4-12-78	II Cutting 24-1-79	III Cutting 4-3-79	IV Cutting 4-4-79	V Cutting 1-5-79	Total yield (tonnes/ha)	% increase over control
1. Control	5.43	7.32	14.80	13.36	11.55	52.46 g*	–
2. 30–50 (All P_2O_5 at sowing)	8.83	11.55	20.61	18.95	17.29	77.23 f	47.22
3. 30–100 (All P_2O_5 at sowing)	10.87	14.34	22.50	20.76	19.02	87.49 d	66.77
4. 30–150 (All P_2O_5 at sowing)	12.38	15.93	24.61	22.80	20.91	96.63 ab	84.20
5. 30-50+50 (half P_2O_5 at sowing and half at first cutting)	8.83	15.10	23.40	22.20	19.85	89.38 cd	70.38
6. 30–75+75 (half P_2O_5 at sowing and half at first cutting)	9.96	16.23	25.97	24.23	21.90	98.29 a	87.36
7. 0–100 (All P_2O_5 at sowing)	9.21	12.30	21.90	20.31	18.95	82.67 e	57.59
8. 0–150 (All P_2O_5 at sowing)	10.49	15.40	23.93	22.42	20.61	92.85 bc	77.99

* = Means followed by the same letters are statistically alike at 5% probability level.

legume crop like berseem. Similar findings were reported by Wahhab (1960), Khan and Bhatti (1971), Ahmad *et al.* (1972) and Kasana and Ropal (1979).

It can be seen from the data of per cent increase over control that application of 30 kg/ha starter nitrogen along with 100 and 150 kg/ha P_2O_5 had some effect in increasing the fodder yield compared to the application of same P_2O_5 rates alone. Composited fodder yield data and its statistical interpretation revealed that starter nitrogen plus 150 kg/ha P_2O_5 applied in two equal splits, one half at sowing and one half at first cutting closely followed by the same rate applied at sowing with 30 kg starter nitrogen, produced maximum fodder yield. Control significantly gave the lowest yield.

N and P_2O_5 contents of berseem fodder

The data in Table 2 showed that the highest nitrogen percentage was recorded for various phosphorus rates applied along with starter nitrogen. Control, 100 and 150 kg P_2O_5/ha without starter nitrogen produced fodder with the lowest nitrogen content, suggesting the role of starter nitrogen in increasing the nitrogen content of berseem fodder.

With regard to the phosphorus content of fodder, the data revealed that in general increasing phosphorus application rate caused a linear increase in the P_2O_5 percentage of berseem fodder. Control produced fodder with the lowest percentage of P_2O_5. In reference to the effect of time of phosphorus application on P_2O_5 percentage of fodder it can be stated that application of half the dose of phosphorus at sowing and one half at first cutting was slightly superior to the total amount applied at sowing.

The data conclusively showed that application of 150 kg P_2O_5/ha as SSP, all at sowing or half at sowing and half at first cutting along with the application of a small amount of starter nitrogen was conducive for maximizing berseem yield of good quality fodder. In the light of present findings di-ammonium phosphate (20–54–0) appears to be the right type of fertilizer for application to berseem under the agroclimatic conditions of Pakistan.

Table 2. *Effect of starter nitrogen and time of phosphate application on the N and P_2O_5 contents of berseem fodder.*

Treatments N-P_2O_5 (kg/ha)	N %	P_2O_5 %
1. Control	1.65 bc*	0.400 f*
2. 30-50 (All P_2O_5 at sowing)	1.90 a	0.455 e
3. 30-100 (All P_2O_5 at sowing)	1.87 a	0.509 cd
4. 30-150 (All P_2O_5 at sowing)	1.73 abc	0.552 ab
5. 30-50+50 (Half P_2O_5 at sowing and half at first cutting)	1.77 ab	0.519 bc
6. 30-75+75 (Half P_2O_5 at sowing and half at first cutting)	1.70 abc	0.570 a
7. 0-100 (All P_2O_5 at sowing)	1.61 bc	0.483 de
8. 0-150 (All P_2O_5 at sowing)	1.53 c	0.538 abc

* = Means followed by the same letters are statistically alike at 5% probability level.

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