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EFFECT OF PHOSPHATIC FERTILIZER RATES LEVEL ON GROWTH, CRUDE PROTEIN CONTENT AND NITROGEN FIXATION ABILITY OF ALFALFA AT SOWING YEAR

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Abstract

The experiment was conducted to determine effects of phosphate fertilizers on growth characteristics, crude protein content and nitrogen fixation ability of alfalfa (*Medicago sativa* L) in the sowing year. Two rates of phosphate (200 and 400 kg/ha P) were applied to phosphorus -deficient native soil in Korea and samples were taken every 7 days from the 30th to the 93rd day. Number of branches, root length and dry matter weight at phosphate fertilizer level of 400kg in sowing year more increased than those at 200kg/ha. The number of nodules did not differ due to phosphate fertilizer rate. The crude protein contents of leaves, stems and roots were not significantly affected by the phosphate fertilizer levels, except for those of leaves with 400kg/ha at 72 days after sowing that were higher. The crude protein contents of each plant along the growing stages were higher at the 44th and 72nd day after sowing. The dry weight of roots did not significantly respond to phosphate rates from 30 days to 51 days after sowing, but that was increased at phosphate fertilizer level of 400kg/ha from 51 days after sowing. The amount of ethylene evolved by samples during 2 hours and the calculated amount of nitrogen fixed were higher on phosphate fertilizer level of 400kg/ha from 30 days

to 58 days after sowing, but decreased that.

Keywords: phosphate fertilizer, crude protein, fixation ability, growth characteristics

Introduction

Alfalfa may supply considerable amounts of nitrogen (N) to pastures by N_2 fixation (Vance 1978). It is known that nodulation and N_2 fixation in alfalfa are inhibited under phosphorus-deficient soil at young plant stage (Tesar et al.1954; Sheaffer et al. 1971). Benefits of phosphate fertilizer on N_2 fixation are especially pronounced under combined application with Ca at dry soil (Crocker et al. 1985). Alfalfa, a perennial legume used for cutting and grazing is not cultivated widely in Korea. The cultivated soils of alfalfa in Korea are highly acid and phosphorus-deficient, that is why this has a bad influence on growth and N_2 fixation before winter season. The objectives of this research were to investigate the effects of phosphate fertilizer level on growth, crude protein content and nitrogen fixation ability of alfalfa before winter season.

Material and Methods

The field experiment was conducted using a randomized block design with three replications according to the phosphate application level (200 and 400./ha) in a farm of Kongju National University. Research samples were collected at intervals of 7 days from October 7 to December 9 and nitrogen fixation activity of nodules was measured by using the acetylene reduction method (Hardy et al.1968). Crude protein was analyzed using Keltec Auto 1030 Analyzer. The acidity (pH), organic matter and available phosphorus of the experimental field were 6.59, 0.8% and 70ppm, respectively. The field experiment was carried out on plots of 2×5m where pots (diameter 10cm) were buried in order to measure N_2-

fixation. Alfalfa seeds were inoculated with *Rhizobium meliloti* and sowed in September 7, 1966. Samples were dried at 75 for 72 hours, measured DM weight and analyzed for crude protein. Datas were analyzed separately using analysis of variance to test significance (p 0.05) of treatment effects.

Results and Discussion

The growth characteristics of alfalfa, according to phosphate fertilizer are shown in Figure 1. The dry matter weight was significantly different between phosphate application levels, so dry matter weight at 400kg/ha was higher than those at 200kg/ha from 30 to 86 days after sowing. These results agree with those of Sheaffer et al. (1971) and Tesar et al. (1954), who found that phosphate greatly influenced dry matter weight at young plant stage. Root length at 200kg/ha from the 30th to the 44th day was higher, but those at 400kg/ha increased more than those of 200kg/ha from the 51st day after sowing, as reported by Ball & Teneyck (1980). The number of root branches at phosphate fertilizer level of 400kg in the sowing year had more increase than those of 200kg/ha. The number of nodules was not significantly different among phosphate fertilizer level, because of low temperature. It is apparent from this study that high phosphate application directly influenced the number of branches, root length and dry matter weight in low temperature, but number of nodules was not affected by phosphate application in low temperature. The crude protein contents of leaf, stem and root were not significantly affected by the phosphate fertilizer levels, except for those of leaves at 400kg/ha on the 72-day that were higher. The crude protein content of each part according to growing stages was higher at 44 days and 72days after sowing. Dry weight of roots, amount of ethylene in the samples taken at 2 hours and calculated amount of nitrogen fixation are shown in Table 1. The dry weight of roots was not significantly different between phosphate fertilizer levels from 30

days to 51 days after sowing, but was higher at phosphate fertilizer level of 400kg/ha from 51 days on. The amount of ethylene evolved from samples during 2 hours and the calculated amount of nitrogen fixation were increased at phosphate fertilizer level of 400kg/ha from 30 days to 65 days after sowing, but decreased from the 58th day on. It is apparent in this study that the effect of phosphate application before the winter season does not influence the number of nodules and the crude protein content, because of low temperature, but acetylene reduction activity and calculated amount of nitrogen fixation were influenced by the development of the root system

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Root (Dry wt./10	P_2O_5 level (kg/ha)	Days after sowing									
		30	37	44	51	58	65	72	79	86	93
Root	200	0.20	0.25	0.24	0.56	0.82	0.87	1.10	1.44	1.68	1.86
(DMg/10 plant)	400	0.15	0.27	0.21	0.51	0.85	1.00	1.31	1.69	2.29	1.36
N_2-fixation	200	20.1	89.9	29.2	193.5	1,465.1	743.6	1,645.0	731.1	1,171.2	1,086.0
(nmol/plant/ha)	400	34.3	276.4	585.1	446.3	1,706.1	1,161.1	698.5	662.8	955.2	629.5
Calculated amount	200	0.03	0.09	0.03	0.21	1.67	0.83	1.84	0.81	1.47	1.31
N_2-fixed(kg/ha/day)	400	0.04	0.30	0.65	0.49	1.91	1.40	0.78	0.69	1.07	0.70

Table 1 – Dry root weight and N_2-fixation by alfalfa as affected by phsphorous levels and plant age.

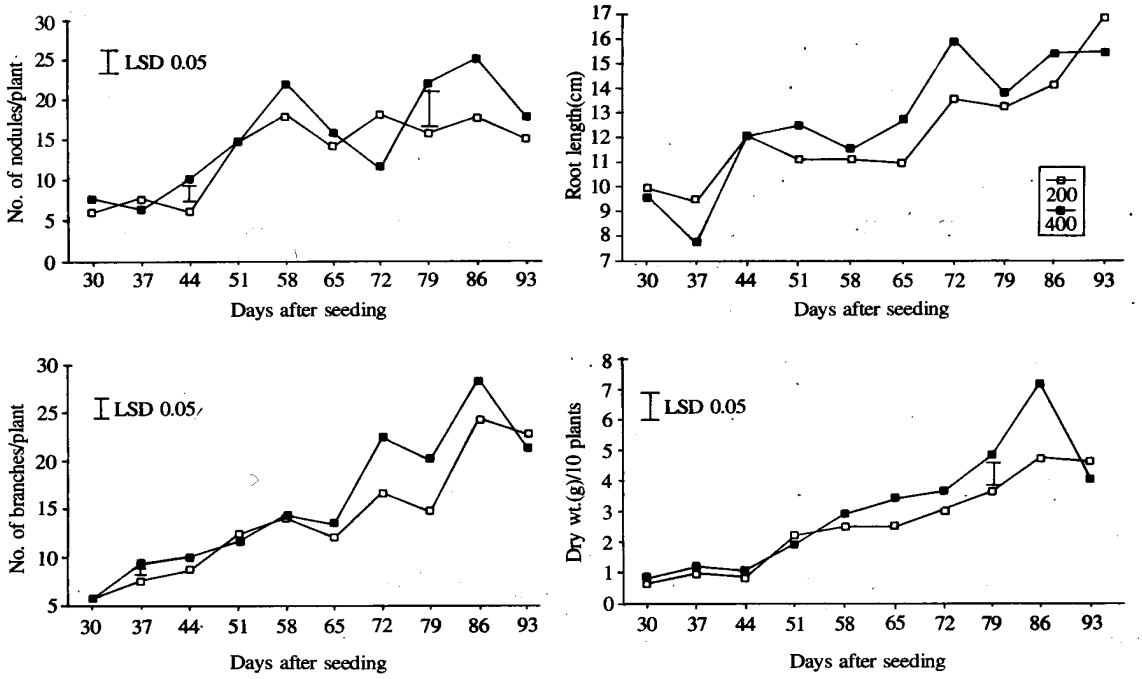

Figure 1 – Effect of phosphorus rates (Kg/ha) on growth characteristics of alfalfa.