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EFFECT OF PHOSPHORUS LEVEL ON HERBAGE QUALITY OF WHITE CLOVER GENOTYPES

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SUMMARY

Seven better performing genotypes of white clover, identified on basis of morphological, yield and quality parameters, were used to study the effect of phosphorus application on biomass quantity and quality in pot trial. Four levels 0, 13, 27 and 40 mg/kg soil of phosphorus fertilizer were applied and five replicates were used. The genotypes differed significantly in biomass production from four cuts taken in one year of the study. The study revealed that whereas with the increase in phosphorus level, the biomass production decreased, the crude protein (%) increased. It can be attributed to role of phosphorus in root and nodule development and thereby indirectly in N fixation.

A number of studies have been conducted on phosphorus fertilization of white clover pastures. Most of these studies were carried out on establishment and development of mixed pastures (Wolfe and Lazenby, 1973; Rangeley and Bolton, 1986; Schills, 2002) and a few in monocultures (Caradus, 1992, 1994; Caradus *et al.,* 1993; Bailey and Laidlaw, 1998). In pasture studies, it was reported to respond positively to phosphorus dose initially but later with the growth of associated grasses, it lags behind. However, adverse effects of P deficiency on clover leaf development and stolon branching at establishment have also been reported (Rangeley and Bolton, 1986; Hart and Collier, 1994; Bailey and Laidlaw, 1998). But none of these studies revealed any effect of phosphorus on herbage quality. Therefore, the present study was undertaken to find out the effect of phosphorus on the quality and quantity of herbage harvested from white clover genotypes.

MATERIALS AND METHODS

Seven better performing genotypes of white clover, identified on the basis of morphological, yield and quality parameters, were selected for the present study. Stolons with four growing tips were cloned in pots containing potting mixture (soil, sand and organic manure). Four treatments of phosphorus 0, 13, 27 and 40 mg/kg soil were applied with five replications. The stolons were grown for one year. The above ground biomass was harvested after four months of planting and then at interval of 60 days. The data from four cuts were combined to find production in one year and were used for the present study. The herbage was analyzed for crude protein, NDF and ADF. However, effect of phosphorus fertilizer on crude protein has been discussed in this paper. The differences between means were tested for significance by analysis of variance and the experiment was analyzed as fully randomized block design.

RESULTS AND DISCUSSION

During the present study, it was found that genotypes differed significantly in biomass production (Table 1). The difference in biomass production was found to be statistically significant (P=0.01). The maximum year round herbage was collected from genotype L 19 (252 g) and minimum from genotype L 100 (21.3). Caradus *et al.* (1993) reported that white clover genotypes differed significantly in harvest. This can be attributed to significant differences between white clover genotypes. A lot of variability between white clover is on record (Caradus *et al.,* 1989; Sareen, 2003) which has been attributed to open pollinated nature of the species.

Phosphorus application also affects biomass production but the difference is statistically non-significant. The maximum mean yield of 124.4 g was

obtained, when no P was applied and minimum of 99 g, when 40 mg P/kg soil was applied. This means that biomass production decreased with increase in P level. Caradus (1994) reported that the percentage change in shoot yield from first to last harvest was negatively correlated with soil P level from which ecotypes collected. Schills (2002) reported that phosphorus application did not increase clover yield and there was negative effect of P application on clover proportions in mixed sward.

The genotypes differed significantly in the quality of herbage produced (Table 2). The mean crude protein was maximum in genotypes L 100 (22.88%) and L 27 (22.80%) and minimum in L 19 (20.22%). However, phosphorus application did not affect crude protein significantly. Unlike biomass production, the crude protein increased with increase in P level. The mean crude protein at P1 level (0 mg P/kg soil) was 20.8 per cent but at P3 and P4 (27 and 40 mg P/kg soil), it was almost 22 per cent. Another significant observation that emerges from these data is that the genotypes which produced maximum biomass had least crude protein. Genotype L 19, which produced 252 g biomass, had 20.2 per cent crude protein and genotype L 100, which produced 21.3 g biomass, had 22.9 per cent crude protein. Phosphorus was applied as basal dose. It is utilized by the plants for development of roots and nodules. P plays an important role in the development of roots by young plants and is vitally important for the formation of root nodules which have a very high P requirement (Marschner, 1995). Therefore, phosphorus application did not increase the biomass production. But with the development of nodules, it is supposed that N-fixing capacity of these genotypes is increased and that led to presence of more crude protein in their herbage with the increase of P level.

TABLE 1
Biomass production in white clover genotypes at different P levels

Genotype	Phosphorus level (mg/kg soil)				Mean
	0**	13**	27**	40**	
L 10	110.14	74.86	100.11	67.41	252.07
L 13	152.33	101.91	133.28	112.21	124.93
L 19	243.22	285.04	258.07	221.94	88.130
L 23	168.60	212.02	179.22	197.00	189.21
L 27	73.61	55.18	62.01	66.47	64.32
L 99	83.66	42.14	85.76	19.76	21.29
L 100	39.27	22.65	14.70	8.52	57.83
Mean	124.40	113.40	119.02	99.04	113.97
C. D.	62.53	43.67	40.29	45.19	

**Significant at P=0.01.

TABLE 2
Crude protein (%) in herbage of white clover genotypes harvested at different P levels

Genotype	Phosphorus (mg/kg soil)				Mean
	0	13	27	40	
L 10	20.89	20.36	19.75	19.96	20.24
L 13	20.85	22.35	23.35	20.77	21.83
L 19	18.63	21.39	20.32	20.53	20.22
L 23	19.58	19.16	22.88	23.78	21.35
L 27	23.03	22.47	22.60	23.10	22.80
L 99	21.22	22.93	23.02	22.57	22.44
L 100	21.88	23.44	23.21	22.99	22.88
Mean	20.87	21.73	22.16	21.96	21.68
C. D.	2.10	3.86	2.00	1.39	

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