Productivity of White Clover-Grass Mixed Swards

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Introduction

Dairy farming is a major branch of agriculture in Latvia. Therefore, providing livestock with high quality grass forage over the whole grazing season is of great importance. However, the cost of obtaining high quality grass forage should not be too high. Perennial forage legume-grass stands meets the required demands best of all. Inclusion of white clover in legume-grass stands contributes to the production of high quality herbage swards (Frame and Newbould, 1986; Laidlaw *et al.*, 1995; Orr *et al.*, 1990; Van Bockstaele, 1985). The nutritive value of white clover depends on the favorable leaf: stem ratio in total herbage at flowering stages it is up to 65-70 and 15%, respectively (Taylor, 1985). White clover-grass swards are successfully utilized when replacing the summer grazing by feeding green cut forages to livestock. Being grown in mixtures with grasses different by height, leafage, regrowth ability and other biological traits, survival and persistence of white clover in a sward has become topical under many fold-cut treatments.

Materials and Methods

The field trials were conducted on sod calcareous soil (pH_{KCl} was 6.7, mobile P - 52, K - 128 mg kg^{-1} of soil). Binary- and multi-species seed mixtures were composed of white clover (*Trifolium pratense* L.) cv. 'Priekulu 61' and grass species: *Alopecurus pratensis* L., *Bromus inermis* Leyss, *Dactylis glomerata* L., *Festuca pratensis* Huds. , *Festuca rubra* L. Huds., *Festuca arundinacea* Scheb., *Phleum pratense* L., *Lolium perenne* L., *Poa pratensis* L. The total seeding rate of each seed mixture was 1000 germinating seeds per m^2. The trials were arranged in randomised complete blocks in three to four replications. Pure stands were cut three, but mixtures three and four times during the growing season. The plots were fertilized: P 40 and K 150 kg ha^{-1}, and two N-fertilizer treatments N 0, N $90_{(45+45)}$. The botanical composition of the sward was determined both between growing stages and for each cut.

Results and Discussion

White clover in binary mixtures with grasses develops productive forage grass swards with the average dry matter yield ranging from 6.60 to 6.77 t ha^{-1} under three-cuts in 5 years of sward utilization and 6.17 to 6.55 t ha^{-1} under four-cuts in a growing season receiving no fertilizer.

The input of mineral N increased the productivity of white clover-grass swards up to 7.39-8.15 and 6.86-7.39 t DM ha^{-1}, respectively. There was little DM advantage - extra 0.67 to 1.01 t ha^{-1} with an input of 90 kg N ha^{-1}, splitting the fertilizer into two applications.

Early top grasses in combinations with white clover produced average DM yields 7.14 to 8.78 t ha^{-1}; medium early and late top grasses provided average DM yields 7.47 - 8.94 and 7.19 - 9.26 t ha^{-1}, respectively. In mixtures with companion bottom grasses DM yields 5.94 - 8.45 t ha^{-1} were obtained under four cuts in a growing season. Three cuts in a season resulted in DM yield increase by 0.28-0.98 t ha^{-1} (Table1).

The average CP yields from 167 to 234 g kg^{-1} in dry matter were obtained greatly due to white clover content in a mixed sward. Our studies showed that mixed white clover-grass swards provided the CP yields 1.25-1.75 and 1.14-1.63 t ha^{-1} on both soils, respectively. The productivity of mixed white clover-grass stands, depending on the number of cuts and fertilization, was by 0.20 - 1.30 t DM ha^{-1} higher on brown-lessive soils. It could be explained by better survival of white clover in mixed swards on sod calcareous soils. Depending on the phytocenotic activity of grasses, the dynamics of white clover content in swards receiving no fertilizer N between the years of sward utilization under four cuts was as follows: 36.7 to 45.2% and 44.7 to 55.2% in the first and second years, and 32.7 to 40.1%, 29.6 to 35.8% and 27.9 to 33.5% in the third, fourth and fifth years, respectively. On these soils the coexistence of white clover and grasses in a sward was subjected to greater fluctuations, particularly during dry periods.

Table 1: DM yield of white clover/grass swards, t ha^{-1} (average from 2 trials)

Regime of cutting (F_A)	Nitrogen fertilizer kg ha^{-1} (F_B)	Composition of swards (F_C)						Average	Average (F_A)	Average (F_B)
		White clover	Number of components in mixtures							
			Two	Three	Four	Five	Six			
Three - fold	N 0	5.73	6.71	6.60	6.64	6.72	6.77	6.53		6.42
	N 90	6.83	7.39	7.66	7.66	7.60	7.54	7.54	7.03	7.26
Four - fold	N 0	5.98	6.17	6.45	6.55	6.31	6.31	6.31		
	N 90	6.55	6.86	7.10	7.38	6.81	6.98	6.98	6.65	
Average (F_C)		6.27	6.78	6.95	7.06	6.86	6.84	6.84		

F_A $LSD_{0.05}$ = 0.35; F_B $LSD_{0.05}$ = 0.29; F_C $LSD_{0.05}$ = 0.21; Trial $LSD_{0.05}$ = 0.54

Three-cut treatments resulted in significant falls of white clover ratio in swards receiving no fertilizer N compared to fives cuts. Changes in white clover content in these swards were the following: 30.2 to 38.3%, 32.4 to 36.9%, 26.7 to 30.5%, 18.7 to 31.9% and 15.4 to 26.6% in the first, second, third, fourth and fifth years of sward utilization, respectively. Starting with the third year, creeping grasses showed negative influence on the content of white clover on these soils. Stable white clover was in mixtures with smooth meadow grass, white hair-grass, perennial ryegrass, red fescue, meadow fescue and timothy. Tall and phytocenotically active grass species (meadow foxtail, cocksfoot, tall or false oat grass, upright brome and tall fescue) significantly eliminated the ratio of white clover in a stand, particularly under three cuts. Perennial ryegrass under adequate soil moisture conditions in the first two years and red fescue at the second year of sward utilization badly effected white clover content in a binary clover-grass sward, particularly when receiving fertilizer N.

Conclusion

Mixed white clover-grass swards have high and comparatively stable productivity. Most productive white clover/grass swards were composed from 3 to 6 species providing the average yields from 6.95 to 7.12 t ha^{-1} DM. The dry matter yields were increased when grasses were grown in mixtures with white clover. Yields and average legume content were the highest in the first, second, third year and decreased in the fifth year of sward utilization. White clover has a stabilizing effect on the distribution of the whole yield during the grazing season. The yield of white clover-grass mixtures is rich in protein.

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