Productive longevity of different alfalfa varieties in the Central non-Chernozem region

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Abstract

Productive longevity of different alfalfa varieties depends on soil fertility, weather conditions, intensity of use and disease incidence. The pasture-type alfalfa (*Medicago varia* Martyn.) variety Pastbischnaya 88 was tested for long-term persistence on well cultivated soils. In the 5th and 6th years of use 36-72 plants were left per 1 m^2 and dry matter yields reached 5-7 Mg ha^{-1}. Thinning of the swards was recorded both after unfavourable winter conditions and due to the diseases in the summer period. By the 15-17th year of use the productivity of alfalfa-based swards declined to 2.8-3.12 Mg ha^{-1}. Being well provided with P and K on the sod-podzolic soil, alfalfa persisted in the mixtures with smooth brome even in its 18th year of use. Presence of 1-7 alfalfa plants per 1 m^2 provided significantly higher yields than pure grass stands. Smooth brome is a good companion grass in alfalfa-grass mixtures for long-term twice-a-season use. This species considerably resisted dandelion invasions and did not suppress alfalfa. The key condition of smooth brome persistence in mixtures with other gramineous grasses is annual application of N_{90}. Without mineral nitrogen fertilization the swards were invaded by wild grasses and dandelion, and the share of smooth brome decreased to 10-18%. On moderately rich soils serious thinning of alfalfa-timothy swards was already recorded in the 4th year after sowing. Their productivity declined to a level of 1.58-2.92 Mg ha^{-1}. Productivity of alfalfa-grass mixtures exceeded that of the single-species timothy crop by 1.8-2.0 times.

Keywords: *Medicago sativa*, yield, productive longevity, variety

Introduction

Alfalfa crops are known to last up to 7-9 years. Planning the approximate period of use for them needs to consider the basic productivity, weed infestation and number of alfalfa plants per square unit. In the first year of use of alfalfa swards, counts of 130-300 plants per 1 m^2 have been recorded, but later this number is reduced dramatically (Berg *et al.*, 2007; Coruh and Tan, 2008). However, decreased productivity is noticed only when alfalfa presence becomes less than 43 plants per 1 m^2. Fewer plants per square unit result in more shoots per plant thus balancing the productivity (Berg *et al.*, 2007). Finding the interrelation between crop productivity, plant density and botanical composition of the swards in long- and short-term field trials helps in assessing the productive longevity of alfalfa, in single-species crops or combined with grasses.

Materials and methods

The field trial was established in 1996 at the experimental station RSAU-MAA n. a. K. A. Timiryazev, located in the Moscow region. The aim was to study persistence of alfalfa in single-species and mixed crops harvested two and three times a year. DM yield was calculated from the green mass harvested from the 25 m^2 plots. The proportions of legumes, grasses and forbs in the yield were found by calculating their percentages by weight. The following variants of swards were studied: grasses (smooth brome and timothy), grasses fertilized with N_{90}, alfalfa cv. Pastbischnaya 88 as a pure stand and in mixture with the grasses, alfalfa cv. Vega 87 and its mixed sward with the grasses. Alfalfa seeding rate was 18 kg for pure stands and 10 kg for the mixtures with smooth brome (*Bromopsis inermis* (Leyss.) Holub) and timothy (*Phleum pratense* L.) (5 kg each). The swards were fertilized with K_{180} till 2007, only because of economic considerations. ANOVA was used to evaluate the differences.

Results and discussion

On sod-podzolic soils alfalfa swards were already thin by the 4-6th years of use, despite these swards rarely suffering from any specific diseases or pests in the Moscow region due to the climatic conditions being untypical for them. In our trial Vega 87 receded to the level of 43 plants per 1 m^2 by the 6th year of management with three harvests per season (Table 1). Thrice-cut Pastbischnaya 88 retained 53 plants per 1 m^2; 2-cuts usage left 51 plants of Vega 87 and 72 plants of Pastbischnaya 88 per m^2 unit. The latter had only 2-17 plants left per 1 m^2 in the 14th year of use and still less in the 17th year (1-7 plants). However, alfalfa made up to 16.3-35.5% of the aboveground herbage mass, and the grasses were moderately competitive.

In their 15-17th years, smooth brome and timothy fertilized with nitrogen provided sustainably high DM yields of 4.58 Mg ha^{-1} on average (Table 2). The unfertilized sward was twice less efficient and invaded with *Dactylis glomerata* L. and forbs. Alfalfa variety Pastbischnaya 88 was more competitive than the older Vega 87, and maintained its high productivity in grass mixtures up to the 17th year of use.

Table 1. Alfalfa plant density per 1 m^2 in single-species crops.

Variety	Year of use				
	1st	2nd	6th	14th	17th
Twice cut					
Vega 87	299	256	51	6	3
Pastbischnaya 88	296	240	72	17	7
Thrice cut					
Vega 87	328	272	43	2	1
Pastbischnaya 88	278	208	53	6	3
Significance *** (P<0.05)	***	***	***	***	***

Table 2. Productivity of twice-cut 15-, 16- and 17-year-old alfalfa swards and mixtures with grasses, Mg ha^{-1} DM

Variant	2011	2012	2013	Average
Grasses (smooth brome and timothy)	2.60	1.59	1.55	1.91
Grasses fertilized with N_{90}	4.80	4.27	4.67	4.58
Alfalfa Pastbischnaya 88	3.26	2.38	3.15	2.93
Alfalfa Vega 87 with grasses	3.32	2.32	2.80	2.81
Alfalfa Pastbischnaya 88 with grasses	3.34	2.88	3.13	3.12
Significance *** (P<0.05)	***	***	***	***

Conclusions

Alfalfa variety Pastbischnaya 88, which is suitable for cutting and grazing, retains sufficient DM productivity of 5-7 Mg ha^{-1} for 5-7 years even in mixed swards with grasses. On poorer soils or if severely diseased, alfalfa stands decline in 3-4 years. Three harvests per season also have a negative effect on the productive longevity of alfalfa, in comparison with twice-cut swards. Smooth brome as a companion species had no suppressing impact on alfalfa and did not affect its persistence.

References

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