

Sowed pastures in the South-Eastern Romanian Plain

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Original Research Article

ABSTRACT

The objective of this study was the identification of the mixtures with elite traits to provide some high-quality fodders, in adequate quantity in the tilled areas sowed in large pastures. Previously, most farms in this area used to cultivate only alfalfa, which is the most important fodder crop in the area. Lately, pastures have been sown with mixtures of Graminaceae and Leguminous varieties, which have superior fodder values. This is possible as these varieties are better adapted to the natural conditions specific to the area. Three mixtures of perennial fodder varieties made of two Graminaceae crops (*Dactylis glomerata* and *Festuca arundinaceae*) and two leguminous crops (*Medicago sativa* and *Trifolium repens*-Ladino) were tested with different mixtures for the years 2016-2019. The results obtained in the first year of harvest (2016) characterised by the climatic conditions over the area showed that the average medium annual production of the three mixtures reached the value of 88.7 t/ha, and this was same as the yield obtained by only alfalfa fodder crop (*M. sativa*). The highest yield was achieved with the first two harvests resulting over 60% of the total yield. The non-uniformity of the climatic factors during the vegetation period leads to a non-uniform distribution of the yield on reapings. Also, the yield obtained with the the third mixture was low (84 t/ha) as a consequence of the lower adjustment capability of white trefoil (*T. repens*) to the droughty climatic conditions.

Keywords: Artificial pasture; sowed pastures; temporary pasture.

1. INTRODUCTION

A few centuries ago, the South-Eastern part of Romania was covered with large grass areas which were characteristic to steppe area and equivalent to savanna, prairie, and pampas [1]. Mixed cropping, also known as polyculture, intercropping, or co-cultivation, is a type of agriculture that involves planting two or more plants simultaneously in the same field, interdigitating the crops so that they grow together. In general, the theory is that planting multiple crops at once saves space, since crops in the same field might ripen at different seasons,

and provides a wealth of environmental benefits. Documented benefits of mixed cropping include the balance of input and outgo of soil nutrients, the suppression of weeds and insect pests, the resistance of extreme climatic conditions (wet, dry, hot, cold), the suppression of plant diseases, the increase in overall productivity and the management of scarce resources (land) to the fullest degree [2]. Agronomists studying mixed crops have had mixed results determining if yield differences can be achieved with mixed versus monoculture crops. For example, a combination of wheat and chickpeas might work in one part of the world, but it might not work in another area.

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However, overall it appears that measurably good effects are obtained when the right combinations of crops are grown together. Mixed cropping is best suited for small-scale farming where harvesting is done by hand. It has been used to improve the income and food production for small farmers and lessen the likelihood of total crop failure-even if one of the crops fail, the same field might still produce the other crop successfully [3-4]. Mixed cropping also requires fewer nutrient inputs such as fertilisers, pruning, pest control and irrigation than monoculture farming. There seems to be no doubt that the practice provides a rich biodiversified environment, fostering habitat and species richness for animals and insects such as butterflies and bees. Some evidences suggest that polycultural fields do produce higher yields compared to monocultural fields in certain situations, and almost always increase biomass richness over time. Polyculture in forests, heathlands, grasslands, and marshes has been particularly important for the regrowth of biodiversity in Europe. A recent study (Pech-Hoill and colleagues) was conducted on the tropical American perennial achiote (*Bixa orellana*), a rapidly growing tree that has a high carotenoid content, and is used as food dye and spice in small farming cultures in Mexico. In this experiment achiote was grown in different agronomic systems, such as-intercropped polyculture, backyard cultivation including poultry farming, and a wide range of plants, and monoculture. Achiote adapted its mating system depending on the type of planting system, specifically the amount of outcrossing. Further research is required to identify the factors for the yield [5-7]. As these large field areas have been sown with specific agricultural crops, the areas left with the initial vegetation (steppe) diminished significantly below 5% [8]. These areas generally consist river meadows that cross the area or with areas provided with a high natural slope which don't allow mechanised agricultural works [9-11]. The results of previous studies showed that the production potential of these steppe natural pastures is very low [12-14]. For this reason, in order to meet the need of local herbivorous animals with necessary fodders, even larger areas from the cropped area (tillable area) have been sown with fodder mixtures consisting of perennial Gramineae and leguminous varieties with superior fodder value and high production potential. To this end, different types of Gramineae and leguminous mixtures have been tested within specific research programs, and the best adapted to specific natural conditions of the area have been considered.

The objective of this study was the identification of the pasture with this elite traits and meeting this major practical important desideratum.

2. MATERIALS AND METHODS

The research was done in the experimental didactical field of Moara Domnească, Ilfov country, agricultural farm of USAMV Bucharest. The harvest was done in 2015 and the experiment was started in the same year. Three mixtures of perennial fodder varieties (Gramineae and leguminous) made of two Gramineae crops (*Dactylis glomerata* and *Festuca arundinaceae*) and two leguminous crops (*Medicago sativa* and *Trifolium repens-Ladino*) were tested with participation shares in different mixtures (Table 1). The mixtures were maintained and exploited according to the technological norms specific to these crop areas. The mixtures with *Medicago sativa* (1 and 2) were used only by threshing, while mixture number 3 with *Trifolium repens – Ladino*, was more appropriate to harvest by grazing. The presence of *Festuca arundinaceae* varieties in the 2nd and the 3rd mixtures was aimed to test its good adjustment to the droughty climatic conditions specific to the area.

In terms of the climate, this area is the driest area in Romania: The medium multiannual temperature is 11.5°C. The coldest month of the year is January with -4°C, and the warmest months is June, July and August with temperature over 21.2°C; 23.1°C and 22.1°C, respectively. Medium-high temperatures in summer months trigger high water shortages in the soil with significant effect over the production.

Multi-annual medium rainfall reaches up to 428 mm/year and doesn't have a uniform distribution. The driest months of the year are January/February and August/ September. The period with the maximum rainfall is May, June and July, but with torrential rain. The low rainfall in the vegetation period (April-September), with a total amount of 290 mm and dominant torrential characteristics lead to the wastage of water by leaking at the surface or evaporation. These climate traits characterise the area as droughty with a negative impact on the productions level. In the absence of irrigations, the solution to obtain good yield for perennial fodder mixtures is the choice of some varieties with better adjustment to these climatic conditions.

3. RESULTS

In order to test the production potential of the three mixtures over four years of harvest (2016-2019), the grass was reaped from the mixtures in blooming/early florescence for both the leguminous plants, *M. sativa* and *T. Repens*. The year 2016 is the first year for testing the production potential of the mixtures, and the results obtained in this year are shown in Table 1.

The highest yields were obtained with the first reaping (between 28-31 t/ha) followed by the second reaping with 21-26 t/ha. The average yields obtained depending on reaping from the three mixtures were of 29.7, 24, 19.7 and 15.3 t/ha green mass. The average production reached to the amount of 88.7 t/ha.

Green mass yield distribution on harvest was not uniform, and the results are presented in Table 2.

The 1st reaping had the highest share in the total yield which was over 30% (32-35). The 2nd reaping had a share of over 25% (25-28). The 1st and the 2nd harvest had a significant share, namely a value of over 60%. This value was determined by the water reserve in the soil as a consequence of the snow melting and of the moderate temperatures of the spring months (March, April and May). The lower share of the 3rd and 4th harvest was determined by the drought in the summer months associated with the air medium temperatures of over 20°C, a fact which leads to a very high evapotranspiration.

Table 1. Green mass yield in 2016 (t/ha)

No.	Mixture	Share in the mixture (%)	Yield on reaping (t/ha)				
			C1	C2	C3	C4	C5
1	<i>Dactylis glomerata</i>	40	28	25	20	15	88
	<i>Medicago sativa</i>	60					
2	<i>Dactylis glomerata</i>	20	31	26	21	16	94
	<i>Festuca arundinaceea</i>	20					
	<i>Medicago sativa</i>	60					
3	<i>Dactylis glomerata</i>	40	30	21	18	15	84
	<i>Festuca arundinaceea</i>	30					
	<i>Trifolium repens-Ladino</i>	30					
Mixtures average			29.7	24	19.7	15.3	88.7

Table 2. Green mass yield share on reaping (t/ha)

No.	Mixture	C1	C2	C3	C4
1	<i>Dactylis glomerata</i>	32	28	22	18
	<i>Medicago sativa</i>				
2	<i>Dactylis glomerata</i>	33	27	22	18
	<i>Festuca arundinaceea</i>				
	<i>Medicago sativa</i>				
3	<i>Dactylis glomerata</i>	35	25	21	19
	<i>Festuca arundinaceea</i>				
	<i>Trifolium repens-Ladino</i>				

4. DISCUSSION

High crop yields are a principal objective of the modern agriculture. Plant breeding has achieved high crop yields through hybridisation and selection of superior plants. These superior types are often grown in monocultures where each plant is genetically identical to its neighbour. The genetic uniformity for plant height, maturity, and quality characteristics also facilitate harvesting, marketing, and processing of the crop. The results showed that Green mass yield (2016) can include the duration of the crop over 8 t/ha. This yields level is close to the alfalfa yield (*M. sativa*), the usual fodder crop for this geographical area.

The higher productions with the alfalfa (*M. sativa*) were 88 t/ha –for the 1st mixture and 94 t/ha for the second mixture, respectively. The 3rd mixture with white trefoil (*T. repens*) achieved only 84 t/ha yield. The lower yield of this mixture is led by the fact that the leguminous variety (*T. repens*) is weakly adapted to the drought conditions in comparison with *M. sativa*. The highest productions were obtained with the first reaping (between 28-31 t/ha) followed by the second reaping with 21-26 t/ha. The results obtained in the first year of harvest (2016) characterised by the climatic conditions over the area showed that the medium annual production of the three mixtures reached the value of 88.7 t/ha, having

the same level as the yields obtained by an alfalfa fodder crop (*M. sativa*), a normal crop for this area. Wolfe [15] defined cultivar mixtures as "mixtures of cultivars that vary for many characters including disease resistance, but have sufficient similarity to be grown together." The results showed that the cultivar mixtures did not cause major changes to the agricultural system, generally increased the yield stability, and in some cases reduced the pesticide use. The results of the study showed that mixed species cropping has been shown to be an effective disease management tool, especially in cereals [16]. For example, Vilich-Meller [17] showed that mixtures of winter-rye/winter-wheat and spring-barley/oats reduced the fungal leaf diseases. Lennartsson [18] reported that a mixture of wheat and *Medicago lupulina* reduced the incidence of take-all disease of wheat, a soil-borne pathogen. The underlying epidemiology has also been extensively modeled [19] from the perspective of varietal mixtures and can simply be explained as the reduced chance of fungal spores encountering a susceptible plant in a mix. The effect tends to improve with an increase in the number of genotypes in the mixture and the randomness of the mixture. Although the epidemiology of airborne epidemics makes them amenable to manipulation by mixed cropping, it could also be expected to alter microclimates within the crop and could affect disease development positively or negatively. It can be concluded from the present study that multiple cropping systems use management practices where the total crop production from a single piece of land is achieved by growing single crops in close sequence, growing several crops simultaneously, or combining single and mixed crops in some sequence. The most important aspect of multiple cropping is the intensification of crop production into additional dimensions. Multiple cropping includes the dimensions of time and space; for example when two crops share the same space at the same time.

5. CONCLUSIONS

Finally, the highest yield was achieved with the first two harvests and it was over 60% of the total. The non-uniformity of the climatic factors during the vegetation period led to a non-uniform distribution of the yield on reapings. Also, the yield obtained with the 3rd mixture was lower (84 t/ha) as a consequence of the low adjustment capability of white trefoil (*T. repens*) to the droughty climatic condition. By setting up pastures sowed with perennial, Graminaceae and leguminous mixtures, one can obtain yields

at least equal to the yield with Alfalfa (*M. sativa*) on par crop, specific to the area and with superior quality traits.

DISCLAIMER

This paper is based on preliminary dataset. Readers are requested to consider this paper as preliminary research article, as authors wanted to publish the initial data as early as possible. Authors are aware that detailed statistical analysis is required to get a scientifically established conclusion. Readers are requested to use the conclusion of this paper judiciously as statistical analysis is absent. Authors also recommend detailed statistical analysis for similar future studies.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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