



Investigating the potential for double-harvesting late-spring crops and mixes in the Central Balkan mountain foremountain areas

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Abstract.

A research was carried out from 2007 to 2009 at the Institute of Mountain Stockbreeding and Agriculture - Troyan on the feasibility of double-harvesting yearly late-spring crops and forage mixes. Various combinations of grass and legume crops, as well as three separate stands of each, were examined in the following ways: The following are the possible combinations: 1. Spring pea "Pleven 4" 2. Sudangrass (Control) 3. Sorghum-Sudangrass hybrid 4. Sudangrass + Spring pea 5. Sorghum-Sudangrass hybrid + Spring pea 1. During the first stage of harvesting, which occurs when grass crops are just starting to bloom, the sorghum-Sudangrass hybrid and its mixture with spring pea outperformed the control stand of Sudangrass in terms of maximum productivity. The hybrid outperformed the control by 55.03 percent, while the mixture with spring pea exceeded it by 51.9 percent. The second cut yields were created by the grass crops at both phases after the initial harvest. Regardless of the stage of first harvesting or the type of stands (mixed or pure), the regions with the highest concentration of seeded fodder crops had the fewest weeds.

Keywords: late spring grass and legume crops, mixtures, twofold harvesting, yields, weed infestation

Introduction

Improving plant productivity and creating new technology components both need the simultaneous harvesting of certain annual fodder crops. Additionally, the agroclimatic resources of each area are used to their fullest potential in this manner. This issue has been investigated both domestically (Aertikov, 2002a; Tertikov, 2002b; Aertikov, 2005) and internationally (Jimenez, 1999; Schultz et al., 2000). Research has shown that under certain cultural settings, it is possible to harvest some legume forage crops twice: once in the winter and again in the spring (e.g., peas and vetch). This practice helps to boost forage yields per unit area. So far, the circumstances in the Central Balkan Mountains' foremountain areas have not been the subject of such investigations. The researchers in this study set out to find out if it would be possible to harvest any annual late-spring grass, legume, or mixed-crop crops in the foremountain conditions of the Central Balkan Mountains (Troyan area) twice.

Material and methods

The experimental field of IMSA, Troyan was used for three years in the spring (late April-early May) on light grey (pseudopodzolic) soil at an altitude of 384 m. A 5 m² harvest plot and 4 replications were used in the block approach. The research aimed to examine the following variations in three different grass and legume crop stands, as well as two mixed stands: 1. "Pleven 4" spring pea 2. "Sudangrass" (Control) 3. "Sorghum-Sudangrass" hybrid 4. "Sudangrass + Spring pea" 5. "Sorghum-Sudangrass hybrid + Spring pea" 16.

The soil was prepared for planting by tillage, which included shallow ploughing, disking, and rotating tillage, until it reached a garden state. The planting dates for the several experimental years varied according to regional climate: 2007–24.04., 2008–10.05., and 2009–19.05.

Spring pea had 120 germinable seeds/m², Sudangrass had 20 germinable seeds/m², and the sorghum-



Sudangrass hybrid had 15 germinable seeds/m². These were the planting rates in the pure stands for the various crops. The combinations included 1:3 weight ratios of grass to legume components. Spread 1 gram of Sudangrass and 84 grams of spring pea per square meter in variety 4, and 8 grams of sorghum-Sudangrass hybrid and 84 grams of pea per square meter in variety 5. While rolling the experimental area before and after planting, the pure and mixed stands were spaced 12 cm apart and sown to a depth of 5-7 cm. Fertilizer was not applied to the experimental area annually. We split the total area of each harvest plot in half. Two phenological phases were used to harvest the stands. Half of the plots were harvested first when the sorghum-Sudangrass hybrid earing or heading occurred, or when the peas were just starting to bloom (1st stage). The other half of the plots were harvested when the grass crops started to flower or when the peas' lower pods began to form seeds (2nd stage). At the time when the grass crops tillered, the second cut was harvested from the experimental area. On an annual basis, the stands were mowed twice. First mowing was done as follows, depending on the stand's readiness: in 2007, on June 22, during the first round of harvesting; in 2008, on

For three years, in the spring (late April-early May), on light grey (pseudopodzolic) soil at an altitude of 384 m, the experimental field of IMSA, Troyan was used. In the block method, a 5 m² harvest area was used with 4 replications. The purpose of this study was to compare and contrast three distinct crop stands, one each of grass and legumes and two mixes: Spring pea, variety "Pleven 4" "Sudangrass" is the control group. Hybrid of "sorghum and sudangrass" 4. "Sudangrass + Spring pea" 5. "Sorghum-Sudangrass hybrid + Spring pea" 16. Tilling, which included disking, shallow ploughing, and rotational tillage, was used to get the soil up to a garden condition, which was necessary for planting. The experimental years' planting dates were 2007-24.04., 2008-10.05., and 2009-19.05. These dates were determined by area climate.

The germinable seed densities of spring pea, Sudangrass, and the sorghum-Sudangrass hybrid were 120, 20, and 15, respectively. The planting rates for the different crops in the pure stands were as follows. Grass and legume components were combined at weight ratios of 1:3. For variety 4, spread 1 gramme of Sudangrass and 84 grammes of spring pea per square meter; for variety 5, spread 8 grammes of sorghum-Sudangrass hybrid and 84 grammes of pea per square meter. Both the pure and mixed stands were evenly spaced 12 cm apart and sowed to a depth of 5-7 cm in the experimental area, which was also rolled before and after planting. The experimental region did not get fertilizer on a yearly basis. We divided each harvest plot's overall area in half. The stands were harvested over two distinct phenological periods. Half of the plots were collected first, either when the peas were just beginning to bloom (1st stage) or when the sorghum-Sudangrass hybrid earing or heading happened. At the beginning of the flowering stage for the grass crops or the beginning of the seeding stage for the peas, the other half of the plots were harvested. The second cut was taken from the experimental area when the grass crops tillered. The stands were mowed twice a year. The first cut took place in the following ways, adjusted for the preparedness of the stand: During the first phase of harvesting in 2007, on June 22; in 2008, on

When the weed infestation begins in the first year of a stand's life cycle, (June–September) was 365.4 l/m² in 2007, 272.4 l/m² in 2008, and 439.2 l/m² in 2009. When looking at rainfall amount, the year 2008 had the lowest supply and the final experimental year (2009) had the highest.

Results and discussion

Table 1 shows the data for the yields of dry mass during the first stage of initial harvesting from 2007 to



2009, broken down by year and averaged throughout that time. Var. 3 (a sorghum-Sudangrass hybrid) clearly outperformed the control (Sudangrass) by 28.68% in the first year (2007). Its dry mass was 17.65% higher in the mixed stands (var. 4) and 16.42% higher in the mixed stands (var. 5), whereas its yield was 36.77% lower in the pure spring pea stand. Compared to the control, the sorghum-Sudangrass hybrid + spring pea combination had a dry mass yield that was 133.14 percent more in 2008 (6360.0 kg/ha). It was outperformed by a sorghum-Sudangrass hybrid by 115.71% and outyielded by the other combination by 44.27%. The forage pea pure stand produced the least amount. Both the sorghum-Sudangrass hybrid and its spring pea blend outperformed the control by 47.56 and 47.19% in 2009, the last year of the trial.

(var.3) in the pure stands and from 88.41% (var. 5) to 91.12% (var. 4) in the mixtures, where the lowest weed infestation was also found - 8.88 and 11.59%, respectively. The stands with spring pea and Sudangrass had the greatest weed infestation - 35.82 and 27.44%, respectively.

In 2008, the sown forage crops also occupied the greatest relative portion in the sown areas, varying in the pure stands from 67.78% for pea to 73.38% for the sorghum-Sudangrass hybrid. The participation of the sown crops in the mixed stands was 87.17% (var.4) and 85.00% (var. 5) at lower weed infestation. Again the stands with spring pea and Sudangrass had the greatest weed infestation - 32.22 and 27.62%, respectively.

In 2009, the forage crops also had the greatest relative portion in the sown areas, varying in the pure stands from 70.62% for spring pea to 84.59% for the sorghum-Sudangrass hybrid. The participation of the sown forage crops in the mixed stands amounted to 95.25% (var. 4) and 96.06% (var. 5) with lower weed infestation - 4.75 and 3.94%, respectively. Again the stands with spring pea and Sudangrass had the greatest weed infestation - 29.38 and 25.02%, respectively.

The data on obtained yields of dry mass with initial harvesting at 2nd stage by years and on average for the 2007-2009 period is given

Table 1. Yields of dry mass in kg/ha by years and on average for the 2007-2009 period at 1st stage of initial harvesting

Variant	2007		2008		2009		Average	
	kg/ha	%	kg/ha	%	kg/ha	%	kg/ha	%
1.Spring pea	3440.0	63.23	1920.0	68.57	1573.3	44.19	2311.1	58.76
2.Sudangrass (Control)	5440.0	100.00	2800.0	100.00	3560.0	100.00	3933.3	100.00
3.Sorghum-Sudangrass hybrid	7000.0	128.68	6040.0	215.71	5253.3	147.56	6097.8	155.03
4.Sudangra ss + Spring pea	6400.0	117.65	4039.7	144.27	3613.3	101.50	4684.3	119.09
5.Sorghum-Sudangrass hybrid+ Spring pea	6333.3	116.42	6360.0	227.14	5240.0	147.19	5977.8	151.98
Gd5 %							111.9	
171 Gd1 %							266.1	
GD0.1 %								

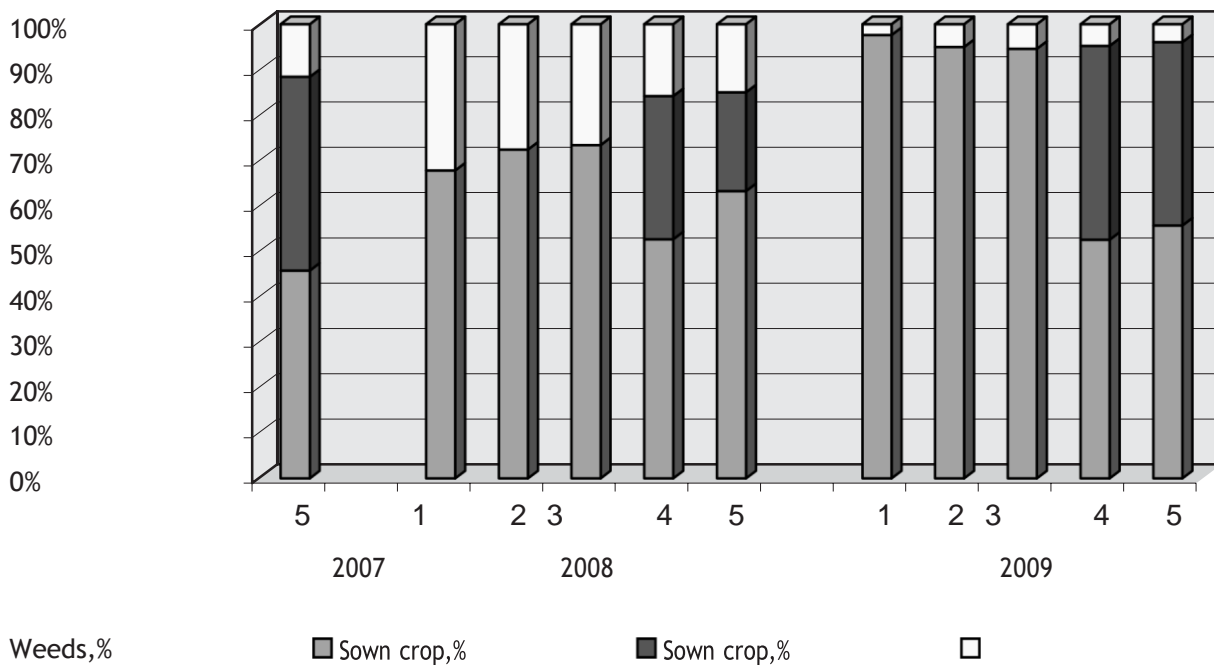


Figure 1. Weed infestation of stands in % by years at 1st stage of initial harvesting

in Table 2. It is evident that in 1st year the highest yield was obtained in var. 3 (sorghum-Sudangrass hybrid) - 12240.0 kg/ha, exceeding the control by 28.03%. The mixture of sorghum-Sudangrass hybrid +spring pea (var. 5) was superior to it in dry mass by 16.60%, whereas the pure pea stand was lower-yielding than it by 65.13% and the mixture of Sudangrass + spring pea (var. 4) - by 12.83%.

In the next year 2008, the greatest quantity of dry mass (9386.8kg/ha) was obtained from the sorghum-Sudangrass hybrid -

At 33.40 percent, the sorghum-Sudangrass hybrid produced the highest yield, whereas the forage pea stand alone produced the least. Over the course of the three years, the sorghum-Sudangrass hybrid and its spring pea combination outperformed the control Sudangrass stand in terms of maximum production, outpacing it by 48.82% and 41.78%, respectively. The combined output of Sudangrass and spring pea was 9.36% more than that of the pure pea stand, which had a dry mass yield that was 51.25% lower. 170.69 percent more than the baseline. The two contrasting displays were According to the same data, the first cut yielded a 61.14% (var. 4) and 92.88% (var. 5) improvement over the previous cut. also outperformed the second cutting in terms of plant yield. Again, among the examined varieties, the pure stand of fodder pea had the lowest yield, with yields ranging from 1.35 times (var. 2) to 4.07 times (var. 5). about the sorghum-Sudangrass hybrid in both its pure and hybrid forms, as well as The highest-yielding variations in the final trial year (2009) were variation 2 and 5, which produced a sorghum-Sudangrass hybrid with spring pea with a yield of 7137.8 kg/ha at 1st mowing and 2928.9 and 3120.0 kg/ha at 2nd mowing, respectively, outperforming the control (Sudangrass) by 45.02%. There has been an uptick in the amount of grass cut. Under this harvesting regime once again, there was

Table 2. Yields of dry mass in kg/ha by years and on average for the 2007-2009 period at 2nd stage of initial harvesting

Variant	2007		2008		2009		Average	
	kg/ha	%	kg/ha	%	kg/ha	%	kg/ha	%
1.Spring pea	3333.3	34.87	3946.7	91.64	2613.3	40.66	3297.8	48.75
2.Sudangrass (Control)	9560.0	100.00	4306.7	100.00	6426.7	100.00	6764.5	100.00
3.Sorghum-Sudangrass hybrid	12240.0	128.03	9386.8	217.96	8573.4	133.40	10066.7	148.82
4.Sorghum-Sudangrass hybrid+ Spring pea	11146.7	116.60	8306.7	161.14	6920.0	107.67	7397.8	109.36
5.Sorghum-Sudangrass hybrid+	11146.7	116.60	8306.7	192.88	9320.0	145.02	9591.1	141.78



Spring pea

167.3

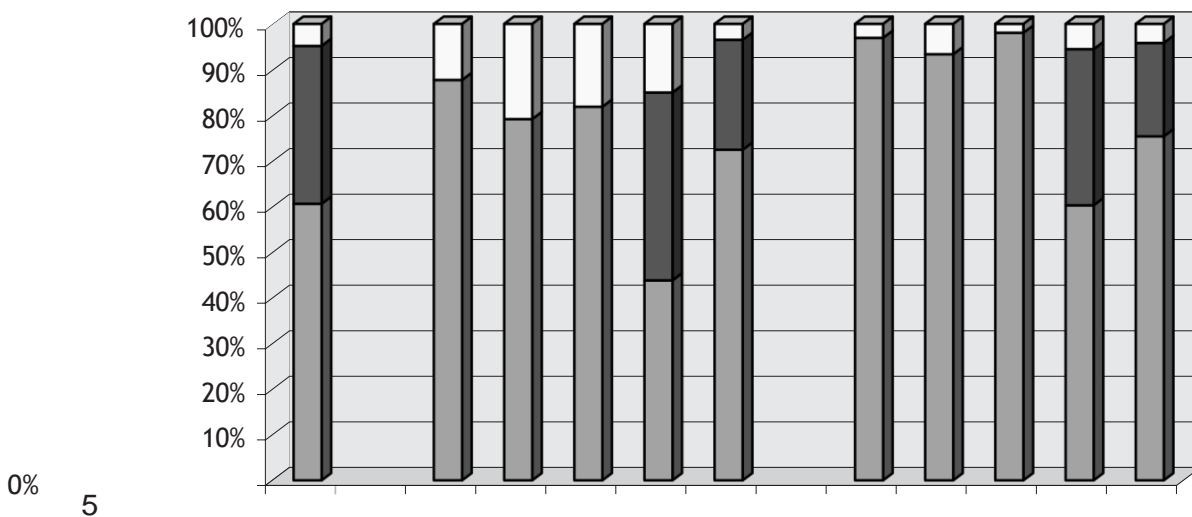


Figure 2. Weed infestation of stands in % by years at 2nd stage of initial harvesting

spring peas do not undergo recurrent growth. To Sudangrass, by 55.03 and 51.98%, and by 48.82 and 41.78%,

At the second stage of initial harvesting, Fig. 2 shows the weed infestation of stands by years. That the seedlings germinated in 2007 in that order. The second cut yields were created by the grass crops at both phases after the initial harvest. Predominance of pasture crops ranged from 82.00% (var. 1) to 98.13%. The sorghum-Sudangrass hybrid showed relatively low weed infestation in both the pure and mixed mixtures, with the highest plant yield observed at the 1st (var. 3) and mowing time points, respectively, of 95.17 percent and 97.97 percent. 2.03% as well as 4.83%. The earliest phases of harvesting were the most weedy. The sowed fodder crops occupied the largest percentage in spring pea (18.00%) and Sudangrass (15.69%), regardless of the stage of first harvesting or the type of the stands (pure or mixed). The acreage devoted to planted fodder crops were the largest in 2008, while those for mixed stands were the smallest. proportion in the planted regions, differing in unsprayed areas plagued by weeds. sorghum-Sudangrass hybrid: 91.83%, pea: 86.79%. In With a participation rate of 94.94% (var. 4), the mixed stands Lower weed infestation was found in 96.49% of cases (var. 5). In pure spring pea stands, it was 12.31%, while in Sudangrass stands, it was 10.90%.

From 83.31% for Sudangrass to 98.04% for the sorghum-Sudangrass hybrid, in 2009 the forage crops in the pure stands took up the most relative space in the planted areas. Although weed infestation was



minimal, the planted forage crops participated in the mixed stands to the tune of 94.44% (var. 4) and 95.82% (var. 5). The highest weed infestation was 13.18% in the spring pea pure stand and 16.69% in the Sudangrass stand.

Conclusion

In the foremountain regions of the Central Balkan Mountains, researchers looked into the possibility of double-harvesting annual late-spring crops and mixtures for feed production. They found that the sorghum-Sudangrass hybrid and its mixture with spring pea had the highest productivity when harvested initially at earing/heading or the start of grass crop flowering. The control stand had a yield of

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