THE EFFECT OF SOWING METHOD ON THE YIELD OF GRASSPEA (*LATHYRUS SATIVUS*) CULTIVATED IN AN ORGANIC SYSTEM

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Abstract. The field experiment was conducted to evaluate how intercropping of the lentil with barley *Hordeum vulgare* or oats (*Avena sativa* L.) as a supporting plant impacts the yield of grasspea (*Lathyrus sativus)* in an organic system. The height of the plants, the height to the first and last pod, the number of pods and seeds on the plant, the weight of seeds on the plant, the air dry weight of the stem of one plant and the weight of the pods, the number and weight of grain per cereal plant, weight of one thousand grains, plant height and number of production shoots were also determined. The field experiment was conducted at the Agricultural Experimental Station in Grabów belonging to the Institute of Soil Science and Plant Cultivation in Puławy. The experimental factors were as follows: (A) the grasspea cultivar (cv.): Derek and Krab; (B) cropping method: sole cropping (without a supporting crop), row intercropping with a supporting crop – barley (cv. Ella) and oat (cv. Bingo). The grasspea seed yield obtained in the treatments with a supporting crops was higher by 11.4% compared with the sole cropped plots. The yield of both grasspea cultivars grown in pure stand and in mixed with cereals, was similar. Seed yield percentage of cv. 'Derek' grown with supporting crops was lower than that of cv. 'Krab'. Higher 1000 seed weight, number of pods, seeds and weight per plant were recorded for both cultivars grown in pure sowing than with supporting crops. Moreover, cv. 'Krab' characterized more favorable structure elements affecting yielding than cv. 'Derek'.
Keywords: *pure sowing, evaluation, supporting plant, cultivar, effect, organic farming*

Introduction

Grasspea (*Lathyrus sativus*) is one of the oldest species of cultivated plants. It was already known around 8000 years ago in ancient Egypt, India, and Roman Empire (Lambein and Kuo, 1997). This species probably originates from the Mediterranean Sea and the Middle and Far East (Lambein and Kuo, 1997). According to Smartt (1984), the center of grasspea origin is south-eastern and central Asia. In the Mediterranean region, the most common to be found are coarse-grained. According to Milczak et al. (1997) on the area of Poland, it appeared the earliest in the Podlasie region. Most probably, grasspea migrated with the settlers as a weed of lentil, and over the years, it became the dominant species due to a higher yield potential than the original species.

Grasspea is characterized by a strong, deep, soil-penetrating, pile root system reaching 1.5 m (Dziamba, 1997; Campbel et al., 1994), which makes it stand out from other legume species due to its high tolerance to abiotic stress (Mc Cutchan, 2003; Vaz Patto et al., 2006). According to Hanbury et al. (1999) and Milczak et al. (2001), its high tolerance to water stress, allows grasspea to be cultivated on weaker soils. The higher productivity of this species in unfavorable (deficit) water conditions compared to other legume species is also pointed out by many authors (Abd El-Moneim, 2000;

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Hanbury et al., 2000; Mc Cuthan, 2003; Rybiński, 2003; Rybiński and Bocianowski, 2006; Rybiński et al., 2010). According to Vaz Patto et al. (2006), taking into account the role of the grasspea in crop rotation, its significant tolerance to diseases and pests, and high nutritional value of the seeds, it is a model species for sustainable agriculture. Due to its low habitat requirements, it may be a competitive species with respect to yellow lupine.

The grasspea seeds were also used for grain, fodder, biomass and green fertilization (Mikić et al., 2010; Basaran et al., 2011). Due to its high biological potential, grasspea have the ability to develop well in a cultivar of environmental conditions and capacity to improve soil fertility (Wani et al., 2012). In general, three main characteristics of this grain legume consist of its massiveness, drought tolerance, and adaptability to a wide range of soil types, including the marginal lands (Ahmadi et al., 2012; Sidorova et al., 2013; Kosev and Vasileva, 2019). There is a growing interest in cultivation of this culture, dictated by the need to restore particularly eroded soils (Polignano et al., 2009).

Grasspea seeds contain a lot of protein and constitute a valuable source of energy components, nutritional fibre and many mineral elements, such as: zinc, copper, sodium, magnesium and calcium (Grela and Günter, 1995; Lampart-Szczapa, 1997; Pisulewska et al., 1997; Hanbury, 2000; Kasprzak and Pzedzicki, 2008; Karadag and Yavuz, 2010). In addition, grasspea seeds are also a rich source of a number proactive non-nutritional components of food, such as inhibitors of prostheses, tannins and neurotoxins, mainly β-ODAP, which may limit the use of seeds, especially in the raw state (Deshpande and Campbell, 1992; Grela et al., 2000; Rybiński and Pokora, 2002; Urga and Fufa, 2005). Moreover, these seeds are considered to have hypocholesterolemic (Fruhbeck et al., 1997) and anticancer properties (Pawlęga et al., 1995). High protein content in seeds of this species makes it suitable for feed and nutrition purposes (Grela et al., 2011). Moreover, restrictions from animal protein in human nutrition, which are caused by health reasons and the popularity of vegetarian diet, cause an increase in the consumption of legume proteins in Poland as well.

The aim of the study was to evaluate the effect of cultivar and sowing method on grasspea yielding cultivated under organic farming system.

Material and methods

Field experiment and cultivation management

During the period from 2017 to 2018, a controlled field experiment was conducted at the Agricultural Experimental Station in Grabów [51°21′18″N 21°40′09″E] (Masovian Voivodeship) belonging to the Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy (Lublin voivodeship) (*Fig. 1*). The experiment was established on a soil belonging to a good rye complex, class IVa. The soil was characterized by the following nutrient content: (mg·100 kg^{-1} soil): P – 11.1-13.0; K – 15.1-20.4 and Mg – 4.0-6.2. Soil pH, as determined in 1 N KCl, was 5.5-6.3. The experimental factors were as follows: (A) – the grasspea cultivar: Derek and Krab; (B) – sowing method: sole cropping (without a supporting crop), and row intercropping with barley (Ella cultivar) and oat (Bingo cultivar).

The experiment was set up as a split-plot design with four replicates. The area of a single plot was 40 m^2 and for harvest – 35 m^2. Each year the total number of plots in the experiment was 48.

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Figure 1. *Localization of the study site (Public Domain, https://commons.wikimedia.org/w/index.php?curid=89531)*

The density (units·m^{-2}) of grasspea in pure cropping was 100, in row intercropping - 50; oat as supporting plant – 250 and barley – 150. Sowing was conducted in the first decade of April. Row spacing is 20 cm. Cereals were sown separately in the interrows of the lentil crop. Mineral fertilization was not applied. The plots were harrowed twice to control weeds in the mixtures. Plants were harvested at the full maturity stage of mixture components at the first decade of August.

The height of the plants, the height to the first and last pod, the number of pods and seeds on the plant, the weight of seeds on the plant, the air dry weight of the stem of one plant and the weight of the pods were determined before harvest. The number and weight of grain per cereal plant, weight of one thousand grains, plant height and number of production shoots were also determined. After harvest, the seed mixtures yield, grasspea seed yield, component percentage in yield and weight of one thousand seeds at 14% humidity were determined.

Weather conditions

Weather conditions during the study period varied substantially between the years (*Table 1*). In 2017 the highest amount of precipitation was recorded in April, exceeded by 77% the long-term average, which made it difficult to perform mechanical maintenance. In June and the first decade of July was recorded a small amount of precipitation (32.6 and 9.7 mm, respectively) and was lower than the long-term average by 54.1 and 65.0%, respectively. It had a negative influence on the growth and development of the plants. In the first decade of August there were occurred very small amount of precipitation (0.9 mm). The average air temperature in this vegetative season exceeded the long-term average by 1.4°C. In 2018, the amount of precipitation in May (97.4 mm) and July (118.5 mm) exceeded the average from multi-years by 70.9 and 41.1%, respectively, which favoured the yields of grasspea. During April and June the total precipitation was only 65% and 63% of the long-term average, respectively. The average air temperature in this vegetative season exceeded the long-term average by 2.4°C.

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Table 1. *Course of weather conditions during the vegetation periods*

Specification	Month						Sum /Mean III-VIII
	III	IV	V	VI	VII	VIII	
2017							
Precipitation (mm)	35.8	69.1	34.4	32.6	86.3	55.3	313.5
Temperature °C	5.7	7.5	13.9	18.1	18.6	19.6	13.9
2018							
Precipitation (mm)	14.1	25.3	97.4	44.6	118.5	70.6	370.5
Temperature °C	-0.1	13.3	17.0	18.4	20.4	20.2	14.9
Mean precipitation from multiyear*	30.0	39.0	57.0	71.0	84.0	75.0	356.0
Mean temperature from multiyear °C	1.6	7.7	13.4	16.7	18.3	17.3	12.5

*Mean from 1871-2000

Chemical analysis of grass pea seeds

The following were determined in seed samples: N (mineralization in sulfuric acid and oxygenated water; determination by the Kjeldahl distillation method; titration detection), P (mineralization in sulfuric acid and oxygenated water; determination by the vanadium-molybdate spectrophotometric method), K (mineralization in sulfuric acid and oxygenated water; determination by flame photometry). Moreover, total protein (mineralization in sulfuric acid; determination by the Kjeldahl distillation method; titration detection), fat content (Soxhlet method) were also determined.

Statistical analysis

Assessing the significance of the impact of the considered factors on the features was based on the variance analysis, indicating Tukey's confidence half-intervals at a significance level of 0.05.

Results and discussion

The yield of grasspea was significantly influenced by the cultivar, cropping method, species of supporting crops, and the course of weather conditions during the growing season. Higher total precipitation in the growing season and a more favorable distribution of precipitation contributed to a much better grasspea yield in 2018 than in 2017 (*Table 2*). The higher yield was the result of higher number of pods and seed weight per plant (*Table 3 and Table 4*). In the both years of the study, the grasspea seed yield obtained in the treatments with a supporting crops was higher by 11.4% compared with the sole cropped plots. The highest yield was obtained by grasspea with oat used as supporting crop compared to cultivation grasspea with barley or sole cropping (statistically significant differences). However, significantly higher yields of grasspea seeds, both of 'Derek' and 'Krab' cultivars, were obtained in sole cropping than in cultivation with supporting crops. Average for 2 years, the yield of both grasspea cultivars grown in pure stand and in mixed with cereals, was similar, whereas in a drier year (2017) cv. 'Krab' yielded better, while in the year with more evenly distributed precipitation (2018), cv. 'Derek' yielded better. Until now, very few studies have been carried out on grasspea taking into account agrotechnical factors, especially cultivation

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with supporting crops. Rachoń (1995) states that the yield of grasspea cropped with triticale or with oats was higher than that of grasspea in sole cropping, and the yields of mixtures with triticale were higher than with oats. Moreover, the yield of the grasspea and cereal mixture, irrespective of the cereal species, increased with an increase in the percentage of cereal in the weight of sown seeds (from 5% to 25%). Karadag and Yavuz (2010) reported that the average seeds yield of from the assessed grasspea lines was 1288 kg·ha^{-1} and ranged from 1079 to 1583 kg·ha^{-1}. Cichy and Rybiński (2007) recorded a very similar yield of seeds as 'Krab' and 'Derek'. It was higher than the yield obtained in own research; 'Krab' by 4.8% and 'Derek' by 6.0%.

Table 2. *Total seeds yield of grasspea and supporting plant and thousand seeds weight of grasspea depending on cropping method*

Cropping method	Seeds yield (t·ha^{-1})			Thousand seeds weight (g)		
	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	2.22^{b*}	3.52^{c}	2.87	122^{ab}	120^{ab}	121
Derek cv. + barley	2.00^{a}	3.84^{d}	2.92	114^{b}	112^{b}	113
Derek cv.+ oat	3.30^{c}	4.03^{cd}	3.67	103^{a}	99^{a}	101
Krab cv. – pure soving	2.53^{b}	3.32^{a}	2.93	176^{cd}	183^{cd}	180
Krab cv. + barley	2.13^{a}	3.44^{b}	2.79	161^{d}	167^{c}	164
Krab cv. + oat	3.44^{c}	3.63^{ab}	3.54	156^{c}	158^{bc}	157
Mean	2.60	3.63	-	139	140	-

*Values followed by a different letter are significantly different ($p<0.05$), Source: own study

Table 3. *Number of pods per plant grasspea depending on cropping method*

Cropping method	2017	2018	Mean
Derek cv. – pure sowing	5.53^{bc*}	6.37^{c}	5.95
Derek cv. + barley	4.18^{c}	5.40^{ab}	4.79
Derek cv.+ oat	2.65^{b}	4.90^{a}	3.78
Krab cv. – pure soving	6.73^{d}	7.10^{bc}	6.92
Krab cv. + barley	3.75^{ab}	5.30^{ab}	4.53
Krab cv. + oat	2.15^{a}	5.03^{b}	3.59
Mean	4.17	5.68	-

*See Table 2, Source: own study

Table 4. *Seed weight and number per plant grasspea depending on cropping method*

Cropping method	Seeds number per plant (units)			Seed weight per plant (g)		
	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	22.1^{bc*}	23.1^{d}	22.6	2.68^{ab}	2.75^{bc}	2.72
Derek cv. + barley	12.6^{c}	19.3^{bc}	16.0	1.43^{b}	1.92^{bc}	1.68
Derek cv.+ oat	7.10^{ab}	17.0^{c}	12.1	0.73^{a}	1.49^{ab}	1.11
Krab cv. – pure soving	21.8^{bc}	17.7^{c}	19.8	3.83^{c}	3.26^{d}	3.55
Krab cv. + barley	6.58^{b}	13.8^{ab}	10.2	1.55^{b}	2.30^{c}	1.93
Krab cv. + oat	4.83^{a}	13.0^{ab}	8.9	0.74^{a}	2.05^{b}	1.40
Mean	12.5	17.3	-	1.83	2.30	-

* See Table 2, Source: own study

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The share in the yield of seeds of cv. 'Derek' cropped with supporting plants was lower than that of cv. 'Krab' (*Table 5*). Moreover, oat was more competitive compared to grasspea than barley, which resulted in a lower percentage of legume seeds in the yield. The share in the yield of grasspea seeds grown with supporting crops, regardless of the cultivar, was much smaller than in the case of sowing, especially in cultivation with oats.

Table 5. *The share and seeds yield of grasspea depending on cropping method*

Cropping method	Grasspea share (%)			Seeds yield of grasspea ($t \cdot ha^{-1}$)		
	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	-	-	-	2.22^{c*}	3.52^{bc}	2.87
Derek cv. + barley	33.8	46.2	40.0	$0.68a^{b}$	1.77^{c}	1.23
Derek cv.+ oat	11.0	39.7	25.4	0.37^{a}	1.52^{b}	0.95
Krab cv. – pure soving	-	-	-	2.53^{d}	3.32^{bc}	2.93
Krab cv. + barley	42.5	47.0	44.8	0.91^{bc}	1.62^{ab}	1.27
Krab cv. + oat	15.0	39.6	27.3	0.51^{b}	1.44^{a}	0.98
Mean	25.6	43.1	-	0.62	1.59	-

* See Table 2, Source: own study

Higher weight of one thousand seeds, number of pods, number of seeds, weight per plant and dry weight of stems and pods of one plant were characteristic for both cultivars grown in sole cropping than with cereals (statistically significant differences) (*Tables 3, 4, 5, 6*). Irrespective of the cropping method, cv. 'Krab' was characterized by higher weight of 1000 seeds, weight of seeds, and number of pods per plant than cv. 'Derek' (*Tables 2, 4, 5*). Cichy and Rybinski (2007) recorded a similar seeds size of these cultivars. According to Milczak et al. (1997), 'Krab' is classified as a medium-seeded cultivar (MTN 193 g) and 'Derek' as a small-seeded cultivar (MTN 115 g). According to Rybiński and Grela (2007), cv. 'Derek' was characterized by higher number of pods and seeds per plant, while lower weight of seeds per plant than cv. 'Krab'. However, Rybiński and Bocianowski (2006) found several times higher number of pods and seeds per plant than in own research. Cultivation of grasspea with spring cereals had little effect on the height of the first pod on the shoot, caused slightly higher settling of the last pod and increased shoot length, especially cultivated with oats (*Table 7*). Moreover, these features showed little difference between the two cultivars. Rybiński and Grela (2007) stated that cv. 'Derek' produced longer shoots and formed the first pod on the shoot higher than cv. 'Krab'. However, in the study by Rybiński and Bocianowski (2006), the mean height of a grasspea was 106 cm (range: 154-40) and the mean height of the lowest pod set was 12.0 cm (range: 18-4 cm).

Talukdar (2009) reported considerable differences in morphological characters such as plant height, number of branches, grain yield and developmental characteristics among grass pea lines. According to Mera et al. (2003), Kumari and Prasad (2005) characteristics such as morphological traits, plant height, number of seed per pod, 100-seed weight, biological yield and harvest index are the most important in grass pea improvement for increasing grain yield. According to Ahmadi et al. (2015) reported that harvest index, 100-seed weight and plant height explained 75% of yield variation. Thus,

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these characters can be effective in yield improvement. Mihailovic et al. (2013) reported that number of plants, plant height, number of stems and lateral branches, number of internodes, green forage yield were highly significantly correlated.

Table 6. *Stem dry matter of one plant and dry matter of siliques depending on cropping method (g)*

Cropping method	Stem dry matter of one plant			Dry matter of siliques		
	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	0.64^{c*}	0.70^{c}	0.67	0.22^{b}	0.17^{c}	0.20
Derek cv. + barley	0.31^{ab}	0.55^{b}	0.43	0.13^{a}	0.13^{b}	0.13
Derek cv.+ oat	0.16^{a}	0.37^{a}	0.27	0.11^{a}	0.03^{ab}	0.07
Krab cv. – pure soving	0.89^{bc}	0.88^{bc}	0.89	0.29^{c}	0.21^{bc}	0.25
Krab cv. + barley	0.24^{b}	0.53^{b}	0.39	0.12^{a}	0.14^{b}	0,13
Krab cv. + oat	0.16^{a}	0.45^{ab}	0.31	0.10^{a}	0.14^{b}	0,12
Mean	0.40	0.58	-	0.16	0.14	-

* See Table 2, Source: own study

Table 7. *Height to the 1st pod, height of the last pod and height to top of grasspea (cm)*

Cropping method	Height to the 1st pod			Height of the last pod			Height to top		
	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	30.4	33.6	32.0	42.3	45.8	44.0	56.3	58.5	57.4
Derek cv. + barley	31.0	30.6	30.8	42.8	41.8	42.3	59.4	52.3	55.8
Derek cv.+ oat	32.0	33.9	32.9	44.3	53.4	48.8	58.9	62.3	60.6
Krab cv. – pure soving	32.5	33.6	33.1	44.6	48.7	46.6	58.2	59.6	58.9
Krab cv. + barley	33.2	34.4	33.8	45.3	45.9	45.6	59.3	58.9	59.1
Krab cv. + oat	36.6	38.1	37.4	47.5	49.5	48.5	60.1	63.1	61.6
Mean	32.6	34.0	-	44.5	47.5	-	58.7	59.1	-

Source: own study

Kosev and Vasileva (2019) reported that the main factor for higher productivity of the varieties was not the maximum display of certain characteristics, but their optimal combination.

A significantly higher protein, crude fibre and phosphorus content was determined in cv. 'Krab' seeds regardless of the cropping method. Whereas cv. 'Derek' contained slightly less fat (*Table 8 and Table 9*). According to Rybiński and Grela (2007), Cichy and Rybiński (2007), cv. 'Derek' seeds collected more protein than cv. 'Krab'. According to Karadagi and Yavuz (2010), the average protein content in seeds was 256.9 $g \cdot kg^{-1}$ DM (from 251.2 to 274.4) and fat content was 42.1 $g \cdot kg^{-1}$ DM (from 32.2 to 50.7). Whereas Rybiński et al. (2013) evaluating many cultivars of grasspea, noted small differences in protein content (statistically insignificant differences), while fat content did not exceed 10 $g \cdot kg^{-1}$ DM. These authors proved a positive correlation between protein amount and fat and linolenic acid content. Sammour et al. (2007) found significant variation for seed weight and seed protein content in accessions of grass pea

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from different geographical regions. Grela and Winiarska (1997) indicate a high dietary value of grasspea, which in their opinion, is similar in composition and usefulness to soybean oil. Williams et al. (1994) reported that the average fat concentration in the tested seeds of the cultivars was about 6.0 $g \cdot kg^{-1}$ DM. According to Grela and Winiarska (1997), the phosphorus content in the grasspea seeds ranged from 0.1 to 5.5, while potassium from 1.0 to 10.4 $g \cdot kg^{-1}$ DM. The limited amount of precipitation (in 2017) favourably influenced the protein concentration in the seeds, but also caused a higher accumulation of fibre and phosphorus. Cultivation of grasspea in row intercropping with cereals did not significantly affect the accumulation of nutrients in the seeds.

Table 8. *Concentrations of protein, crude fibre and crube fat in grasspea seeds depending cropping method ($g \cdot kg^{-1}$DM)*

Cropping method	Protein content			Fat content			Crude fibre		
	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	269^{a*}	257^{a}	263	12.0^{ab}	13.0^{bc}	12.5	50.3^{a}	39.4^{a}	44.8
Derek cv. + barley	270^{a}	258^{a}	264	11.0^{b}	14.0^{c}	12.5	51.2^{a}	42.3^{c}	46.7
Derek cv.+ oat	269^{a}	258^{a}	263	11.0^{b}	13.0^{bc}	12.0	52.1^{a}	41.7^{b}	46.9
Krab cv. – pure soving	294^{b}	270^{b}	282	10.0^{a}	12.0^{a}	11.0	68.3^{b}	49.6^{ab}	58.9
Krab cv. + barley	291^{b}	270^{b}	281	11.0^{b}	13.0^{bc}	12.0	69.1^{b}	52.3^{bc}	60.7
Krab cv. + oat	293^{b}	272^{b}	283	12.0^{b}	12.0^{b}	12.0	67.8^{b}	51.9b^{c}	59.8
Mean	281	260	-	11.0	13.0	-	59.8	46.2	-

* See Table 2, Source: own study

Table 9. *Concentrations of phosphorus and potassium in grasspea seeds depending on cropping method ($g \cdot kg^{-1}$DM)*

Cropping method	Phosphorus content			Potassium content		
	2017	2018	Mean	2017	2018	Mean
Derek cv. – pure sowing	5.8^{a*}	4.5^{ab}	5.1	11.2^{b}	12.0^{a}	11.6
Derek cv. + barley	5.8^{a}	4.7^{b}	5.2	11.4^{b}	11.9^{a}	11.6
Derek cv.+ oat	6.2^{b}	4.6^{c}	5.4	12.1^{c}	12.2^{a}	12.1
Krab cv. – pure soving	6.9^{c}	4.9^{bc}	5.9	12.1^{c}	12.0^{a}	12.1
Krab cv. + barley	6.5^{ab}	5.1^{d}	5.8	10.8^{a}	12.3^{a}	11.6
Krab cv. + oat	6.6^{ab}	5.2^{d}	5.9	11.1^{b}	11.9^{a}	11.5
Mean	6.3	4.8	-	11.4	12.1	-

* See Table 2, Source: own study

The studied grasspea cultivars had a relatively weak effect on the height of barley and oat plants, the number of grains per plant, and the number of production shoots of both cereal species (*Table 10 and Table 11*). Moreover, higher 1000 grain weight characterized the mixtures of barley grown with the grasspea of cv. 'Krab' and the mixtures of oats with the grasspea of cv. 'Derek'. Higher grain weight was recorded in oat grown with grasspea of the cv. 'Krab'.

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Table 10. *Number, weight of cereals grain per plant and thousand seeds weight of cereals depending on cropping method*

Cropping method	Number of cereals grain per plant (units)			Weight of cereals grain per plant (g)			Thousand seeds weight of cereals (g)		
	2017	2018	Mean	2017	2018	Mean	2017	2018	Mean
Derek cv. + barley	52.6^{a*}	54.7^{a}	53.6	2.32^{a}	2.39^{a}	2.36	43.0^{c}	47.5^{c}	45.3
Derek cv.+ oat	56.3^{b}	56.9^{ab}	56.6	2.40^{b}	2.48^{b}	2.44	29.3^{b}	33.5^{a}	31.4
Krab cv. + barley	54.5^{a}	55.8^{b}	55.1	2.31^{a}	2.40^{a}	2.36	45.8^{c}	48.5^{c}	47.1
Krab cv. + oat	57.4^{b}	58.3^{c}	57.8	2.46^{b}	2.56^{b}	2.51	28.8^{a}	32.2^{b}	30.5
Mean	55.2	56.4	-	2.37	2.45	-	36.7	40.4	-

* See Table 2, Source: own study

Table 11. *Height plant and number of fruiting shoots depending on cropping method*

Cropping method	Height plant (cm)			Number of fruiting shoots (units)		
	2017	2018	Mean	2017	2018	Mean
Derek cv. + barley	32.0	56.0	44.0	2.63	3.63	3.13
Krab cv. + barley	34.0	56.0	45.0	2.65	3.18	2.92
Derek cv.+ oat	44.0	83.0	64.0	1.95	1.73	1.84
Krab cv. + oat	45.0	87.0	66.0	1.50	1.70	1.60
Mean	39.0	70.0	-	2.18	2.56	-

Source: own study

Conclusions

1) The grasspea seed yield obtained in the treatments with a supporting crops was higher by 11.4% compared with the sole cropped plots. The yield of both grasspea cultivars grown in pure stand and in mixed with cereals, was similar.
2) Seed yield percentage of the ‘Derek’ cultivar grown with supporting crops was lower than that of cultivar ‘Krab’.
3) Higher 1000 seed weight, number of pods, seeds and weight per plant were recorded for both cultivars grown in pure sowing than with supporting crops. Moreover, ‘Krab’ cultivar characterized more favorable structure elements affecting yielding than ‘Derek’ cultivar.

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