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MEASURING OF YIELD AND OTHER TRAITS OF WINTER PEAS VARIETIES ON DIFFERENT PLANTING DATES

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Abstract

The objective of this study was to analyze at NARDI Fundulea (44°26'N latitude, 68 m altitude) the influence of time of planting on yield and other traits at winter peas, as support of the appropriate technological decision. A split plot layout with in randomized block design, with three replications has been applied in this study. Four dates of planting were considered as main plots, respectively: October 11, 2019/October 21, 2020 (autumn) and February 19, 2020/March 03, 2021 (spring), while three replication subplots include twelve winter peas varieties and breeding lines (Lavinia F, Ghittia F, 13008MT28-1, 13020MT, 12018MT1, 12023MT1-1, 13002MT, 12038MT2, 13008MT42-2, 12025MT4, 13020MT1-2, 12004MT2). According to the analyzed variables such plant height, seed yield, TGW and protein content, results suggest that planting in autumn leads to a higher performance of the both TGW and Yield capacity (4838 kg/ha), as compared to the spring one, in this case being registered an yield of 1796 kg/ha.

Key words*: winter peas, grain yield, protein content, plant height.*

INTRODUCTION

Peas (*Pisum sativum* L.) are an ancient crop with extensive ecological and production potential, cultivated for their seeds in the majority of countries around the globe. Peas seeds are used as food, in the processing industry and as feed. Seeds value cherished for their biochemical content, resides in their high content of proteins (27.8%), starch (43.2%) and fats (1.2%) (Muntean et al., 2001; Ungureanu et al., 2018).

Due to several valuable agronomic characteristics pea has been preferably introduced in the main agricultural crop rotations: tolerance to various environment conditions; good adaptability to different soil conditions; fixing of atmospheric nitrogen into the soil; short period of vegetation (Simion et al., 2017).

Peas are important grain legumes. Dry pea cropping has major advantages in sustainable farming systems because of it's low requirement for water, chemicals and fossil energy; ability to symbiotically fix atmospheric nitrogen which precludes the need for N-fertilizer; and reduced emissions of N2O, NO3 and CH4, which, in addition to CO2 savings, significantly reduce the greenhouse effect of agricultural activities (Mukherjee et al., 2013; Munier and Carrouee, 2003).

In cultivated pea a considerable genetic variation was found and numerous varieties characterized by a broad spectrum of desirable agronomic traits have been released from many breeding programs across the world.

Main factors considered to establish the specific technology of cropping pea in terms of varietal productivity, planting date, seeding rate, harvesting conditions, include the local pedo-climatic conditions, end use and marketing options.

Among these, pea cultivar and seeding rate are the most determinant factors on yield parameters. Decreased yield is a sign that seeding rates are above or below the optimum rates (Asik et al., 2020).

Sowing rate influences plant establishment, growth, seed yield, and the profitability of a crop (Loss et al., 1998). Olle and Tamm (2021) affirm that sowing rate of field peas is affected by environmental factors (rainfall, irrigation, temperature, or soil type). The more favourable the environment, the higher will be the optimum density of the sowing rate. Higher densities will also suppress weed growth and this was observed in other research.

This study presents the results obtained at the National Agricultural Researchand Development Institute Fundulea (44°26' N latitude, 68 m altitude), regarding the characterization of yield, protein content, TGW, plant height, as response to different planting dates in 12 Romanian pea.

MATERIALS AND METHODS

The experiments were conducted during the agronomic cycle 2019/2021 at the National Agricultural Research and Development Institute Fundulea (44°26' N latitude, 68 m altitude). Soil texture was cambic cernoziom with the moderate amount of organic matter and nutrient elements. Each experimental plot included six planting rows with the parameters: length (L) = 6 meters, harvested area (HA) = 4 m², distance among rows = 12.5 cm and planting density = 130 plants/ m².

Winter peas cultivars (*Lavinia F* and *Ghittia F*) and the breeding lines *13008MT28-1, 13020MT, 12018MT1, 12023MT1-1, 13002MT, 12038MT2, 13008MT42-2, 12025MT4, 13020MT1-2, 12004MT2*) were analyzed, as subplot factor in a split plot experiment based on randomized block design, with three replications, according to four sowing dates considered as the main plot factor, respectively October 11, 2019/ October 21, 2020 (autumn) and February 19, 2020/March 03, 2021 (spring). The experimental plots were mechanically harvested with Wintersteiger equipment.

Parameters analyzed in this study included: grain yield (kg/ha at 14% humidity), seed protein content (%), thousand grains weight (TGW) and plant height (cm).

Seed protein concentration was determined by near-infrared (NIR) method using a Grain Analyzer (Infratech 1241, Foss Tecator).

The obtained data were statistically calculated by ANOVA.

Climatic conditions, at NARDI Fundulea area are characterized by a continental temperate climate, with uneven distribution of rainfall by months. Temperature (°C) and rainfall (mm) registered across the experimental period, by the Weather station of NARDI Fundulea, are presented in Figures 1 and 2. Weather conditions of the both agronomic cycles during vegetation period of winter peas and especially the grain filling period, were very different.

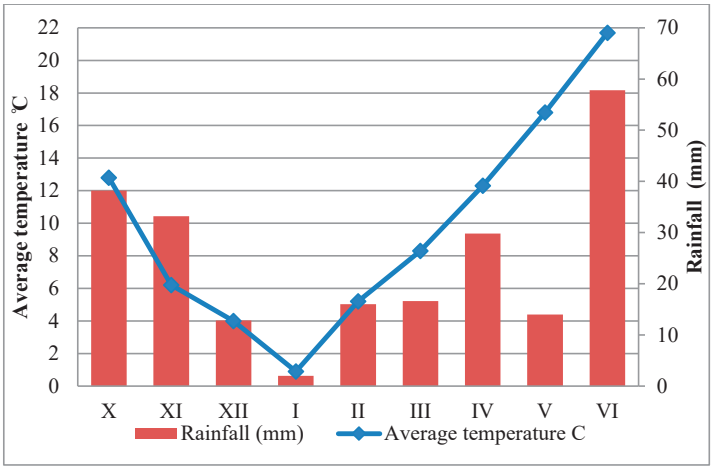

Figure 1. Weather conditions of field pea vegetation period 2019-2020 according to Meteorological Station of NARDI Fundulea

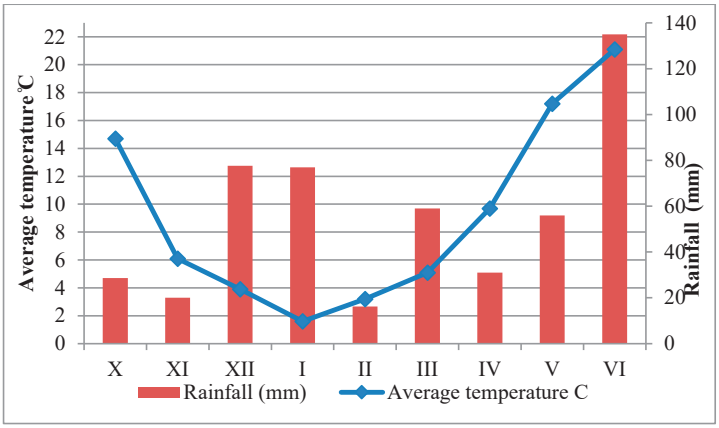

Figure 2. Weather conditions of field pea vegetation period 2020-2021 according to Meteorological Station of NARDI Fundulea

RESULTS AND DISCUSSIONS

The results showed that the time of planting is determinant on yield and other traits in winter peas (Table 1). Results obtained indicate the strong influence of different sowing dates on plant height. The highest value of the plant height (71 cm) was recorded on October 21, 2020, whereas the shortest plant height (51 cm) was recorded on February 17, 2020 (Table 1). Differences among the pea genotypes related to response to the sowing date on the plant height has been also observed.

Lavinia F, Ghittia F, 13002MT and *13020MT1-2* express their high plant type as compared to *12038MT2, 12025MT4,* that could be characterized as short.

Another finding refers to the relation planting date/TGW. Data obtained on TGW varies from 145 g to 170 g (spring sowing system) and from 160 to 200 g (autumn sowing system).

Planting of winter pea in spring system revealed a negative influence on seed yield that was significantly reduced in our study. The both planting dates, respectively February 17 and March 3, caused up to 50% reduced yields (Tables 1 and 2). The highest seed yield has been registered for the genotypes *13020MT* and *13020MT1-2* respectively 4838 kg/ha and 4538 kg/ha.

The protein content also significantly varied among the pea cultivars, as effect of genetic differences related to the potential of biological N fixation (Abi-Ghanem et al., 2013).

Genotypic differences of protein content were also highlighted under field conditions in our trials (Tables 1 and 2).

The lowest values on average for this parameter were registered for the winter peas cultivars sown in autumn (X = 22.98%), in comparison to the values obtained by sowing in spring time (X = 25.62%). The genotypes sown in spring characterized by a high protein content were: *13008MT42-2* (27.8%), *13008MT28-1* (27.3%) and *13020MT1-2* (27%).

Table 1. Effect of planting date on winter peas caracteristics, NARDI Fundulea

Planting date	Plant height (cm)	TGW (g)	Seed yield (kg/ha)	Protein content (%)
Oct. 11st 2019	60.8	183	2980	23
Oct. 21st 2020	75.0	178	5448	22.7
Feb. 17st 2020	51,8	155	2695	25.6
Mar. 3th 2021	63.2	168	1710	24.8

Tabel 2. The mean of agronomical traits of twelve varieties of winter pea

No.	Variety	Planting date	Plant Height (cm)	TGW (g)	Seed yield (kg/ha)	Protein content (%)
1.	Lavinia F	winter	64.5	160	4394	21.2
		spring	62	145	2496	23.8
2.	Ghittia F	winter	71	200	4397	23.4
		spring	60.5	175	2272	25.5
3.	13008MT28-1	winter	64	200	4104	23.7
		spring	57.5	175	2325	27.3
4.	13020MT	winter	62	200	4838	22.5
		spring	61	180	1796	24.9
5.	12018MT1	winter	62	200	3480	22.4
		spring	60	185	2106	25.9
6.	12023MT1-1	winter	59	200	3739	22.7
		spring	56	183	2307	23.5
7.	13002MT	winter	69.5	170	3954	21.6
		spring	57.5	165	2418	23.5
8.	12038MT2	winter	57	173	3580	23.2
		spring	51	165	2105	26.6
9.	13008MT42-2	winter	62	180	3871	23.5
		spring	55	165	1968	27.8
10.	12025MT4	winter	58.5	200	4521	24.5
		spring	48.5	185	2225	26.1
11.	13020MT1-2	winter	76	160	4538	22.9
		spring	58	155	1821	27.0
12.	12004MT2	winter	54	180	4005	23
		spring	58.5	160	2567	25.1
Average values		**winter**	**67.9**	**185,3**	**4118**	**22.98**
		spring	**57.3**	**170**	**2201**	**25.62**

Analyses of variance were performed considering years as a random factor and genotypes as a fixed factor. ANOVA indicated a significant effect of genotypes and years on the protein content, grain weight and plant height (Table 3).

Table 3. ANOVA for average seed yield, average protein, average TGW, and plant heigth for winter peas cultivars, NARDI Fundulea, 2019-2021 period

	Seed yield			**Protein content**		**TGW**		**Plant heigth**	
Source of variation	df	F	P-value	F	P-value	F	P-value	F	P-value
Genotypes	11	0.64	0.76	4.14*	0.013	18.21*	0.00001	3.01	0.04
Years (time of planting)	1	151.2	9.06	75.5**	2.94	62.63**	7.23	22.19**	0.0006
Interaction	11	-	-	-	-	-	-	-	-
Total	23	-	-	-	-	-	-	-	-

CONCLUSIONS

Cultivation of winter pea in either autumn or spring planting systems is possible and could be decided depending on the immediate needs of farmers:

- Planting in autumn allows a more efficient use of humidity during the winter season, a less vulnerability to the spring droughts and a longer vegetation period that determine a higher productivity, grain yield and TGW, respectively;
- High protein content are achieved mainly when the winter pea crop is established in spring time.

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