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THE INFLUENCE OF PERIOD OF SOWING OF WINTER FODDER PEA VARIETY ON TUBER-FORMATION AND PLANT RESIDUES CONTENT FOR IMPROVING SOIL FERTILITY

Ivan Pachev, Svilen Raykov, Ivan Dimitrov[1], Dragica Spasova[2]

Abstract

The study of plant-microbial associations is important for the development of modern farming and environment ecology. In the process of the gradual reduction of import quantities of mineral fertilizers and pesticides to increase the plants productivity and yield it is necessary to activate the agrocenoses biological components, where learning about the legume bean-rizobial symbiosis is very important. Increasing the reserves of symbiotic nitrogen-fixation, mobilization and provision of the plants with environmentally safe biological nitrogen and its storage in the soil are the reasons for constant researches and experiments.

The purpose of this study is to determine the influence of the period of sowing on the development of the root mass, tuber-formation, the amount of post-harvest residues and soil agrochemical composition of winter fodder peas. The experiment is made in the period of 2005 to 2008 in Pleven EFC with the method of random block system. The results show that in the first sampling maximum number of tubers (26.62 g plant) and root dry weight (1.55 g/plant) were formed in a second sowing period (10-15 October), but with the greatest amount of post-harvest residues (435.5 kg/ha) are those of the a third period (25-30 October). After the harvest and the secondary growing of peas the indicators value are lower by 76.2, 30.2 and 61.6%.

The agrochemical soil analysis shows pronounced trends in mineral nitrogen and organic carbon content under the influence of different sowing periods. The soils where the plants are harvested from later sowing time are

1). Shumen University "Bishop K. Preslavski", Shumen, Republic of Bulgaria. **rajkov_svilen@abv.bg**

ШУ "Епископ Константин Преславски", Шумен, Р. България. rajkov_svilen@abv.bg

2). Goce Delcev" University- Stip, Faculty of Agriculture, Goce Delcev bb 2400 Strumica, Republic of Macedonia. **dragica.spasova@ugd.edu.mk**

Универзитет „Гоце Делчев" – Штип, Земјоделски факултет, ул. Гоце Делчев бб, 2400 Струмица, Р. Македонија **dragica.spasova@ugd.edu.mk**

characterized with high nitrogen and carbon content determined by the larger root volume and post-harvest residues in these terms. After the pea harvest the current and potential soil acidity values decreased by 2.7 and 5.5 percent compared with the control variant.

Key words: *peas, symbiotic nitrogen-fixation, plant residues, root mass.*

ВЛИЈАНИЕ НА РОКОТ НА СЕИДБА КАЈ ЗИМСКИОТ ФУРАЖЕН ГРАШОК ВРЗ ФОРМИРАЊЕТО ГРУТКИ И СОДРЖИНА НА РАСТИТЕЛНИТЕ ОСТАТОЦИ ЗА ПОДОБРУВАЊЕ НА ПЛОДНОСТА НА ПОЧВАТА

Иван Пачев, Свилен Рајков, Иван Димитров, Драгица Спасова

Краток извадок

Проучувањето на растителните микробиолошки асоцијации е од големо значење за развитокот на модерното земјоделство и екологијата на околината. Во процесот на постепено намалување на внесените количини минерални ѓубриња и пестициди за зголемување на продуктивноста и приносот на растенијата, неопходно е да се активираат биолошките компоненти на агроценозите, од кои важно место зазема проучувањето на симбиозата меѓу легуминозите и ризобијалните бактерии. Зголемувањето на резервите на симбиотската азотофиксација, мобилизацијата и обезбедувањето на растенијата со еколошки безопасен азот и негово складирање во почвата се основа за постојани проучувања и експерименти.

Целта на ова испитување е да се одреди влијанието на рокот на сеидба кај зимскиот фуражен грашок врз развојот на кореновата маса, формирањето на грутковите бактерии, количината на растителните остатоци по жетвата и агрохемискиот состав на почвата. Опитот е воден во периодот 2005 – 2008 година во ИФК – Плевен по методот на рандомизирани парцели. Резултатите покажуваат дека во првиот откос максимален број ѓрутки (26,62 g/растение) и сува коренова маса (1,55 g/растение) формираат растенијата во вториот сеидбен рок (10 – 15 октомври), а со најголемо количество растителни остатоци по жетвата (435 kg/ha) даваат растенијата од третиот рок на сеидба (25 – 30 октомври). По косењето на фуражниот грашок и неговото повторно растење, вредностите на разгледуваните показатели се пониски соодветно за 76,2%, 30,2% и 61,6%.

Агрохемиската анализа на почвата покажува добри резултати во однос на присуството на минерален азот и органски јаглерод под влијание на различните сеидбени рокови. Почвите на кои се врши жнеење на растенијата од подоцните сеидбени рокови се карактеризираат со повисока содржина на азот и јаглерод, како резултат на поголемиот волумен на кореновата маса и растителните остатоци по жетвата во тие рокови на сеидба. По жетвата на фуражниот грашок вредностите на актуелната и потенцијалната киселост на почвата се намалуваат соодветно за 2,7% и 5,5%, споредено со контролната варијанта.

Клучни зборови: *зимски фуражен грашок, формирање грутки, растителни остатоци.*

1. Introduction

The study of plant-microbial associations is important for the development of modern farming and environment ecology. In the process of the gradual reduction of import quantities of mineral fertilizers and pesticides to increase the plants productivity and yield it is necessary to activate the agrocenoses biological components, where very important is learning the legume bean-rizobial symbiosis (Kots et al., 2007). Increasing the reserves of symbiotic nitrogen-fixation, mobilization and provision of the plants with environmentally safe biological nitrogen and its storage in the soil are reasons for constantly researches and experiments.

Tuber bacteria usually spread by certain types of satellites legumes. Biological nitrogen accumulated in soil from nitrogen-fixating microorganisms is essential for agriculture. In good development peas accumulates about 150 kg / ha (Sabelnikova, 1974). Most effectively tubers fix nitrogen during the active growing season to start plants butonization. During the bloom they are less efficient and begin to disintegrate. After tubers demolition they fall into the soil and survive there on the account of organic substances contained there. They may exist saprophytically infinitely long time waiting for a meeting with the roots of legumes. In the opinion of Mishustin (1972) and Shilnikova (1968) continued existence of tuber bacteria is possible only when fresh plant residues enter into the soil.

The factors affecting positively on the tuber-formation and activity of tuber bacteria (Peoples et al., 1995) include aeration of the soil, the soil humidity, reaction, nutrient regimen, etc., which are largely determined by the technology of the legumes cultivation.

The purpose of this study is to determine the influence of the period of sowing on the development of root mass, tuber-formation, the amount of post-

harvest residues and soil agrochemical composition of wintering fodder pea to improve soil fertility.

2. Material and methods

The experiment is made in 2005-2008 period in EFC-Pleven. The soil type is poorly leached black earth. A winter pea variety Mir is used. Experiments are set by the method of randomized block design in four replications, with plot size 10 m2. Phosphorus (60 kg/ha) and potassium fertilizer (40 kg/ha) have been introduced before the primary soil tillage and nitrogen (50 kg/ha) – in early spring. Sowing was carried out with a propagation rate 120 pcs.k.s./m2 in three preceding periods: 25-30 September, 10-15 October (optimum time for sowing of winter peas in the region of Central Northern Bulgaria) and 25-30 October. The mowing of the first sprout was carried in boot phenophase -25% flowering at a height of 15-20 cm, and the second sprout - in the legume milk stage of maturity of the height 5-6 cm. Harvesting is mechanized with BCS mower.

Before mowing the plots were divided in two parts. The mowing of the one part of the plot was carried out in boot phenophase -25% flowering, and the second - 10 days after flowering completion, taking into account the following indicators: weight of the root mass, post-harvest residues and tuber-formation. In the same phase soil samples are taken from all the variants to determine pH changes in soil (with potentiometer, in watter extract and in KCl, by Atanasov and others, 1979; Velchev and others, 1982; Totev and others, 1987), mineral nitrogen content - ammonium and nitrate form (by Kornfiyld), phosphorus (by Egner-Riym) and organic carbon (by Kononova and Belchikova, 1965; Laktionov, 1985).

3. Results and discussion

The average data for three-year period of study indicate that sown in a second period of sowing (10-15 October) fodder pea is characterized by the highest weight of dry root mass and number of tubers of one plant (Table 1). Most abundant post-harvest residue (660.8 kg/ha), however, are formed in the last third period of sowing (25-30 October).

The differences in the value of the indicators between the different options from the samples taken from the second mowing part are considerably smaller than the samples taken from the first mowing part and in most cases are statistically unproven. The tubers number of one plant and the amount of root dry mass and post-harvest residues are lower by 76.2, 30.2 and 61.6 percent, as the probable reason for this is the deteriorated agro-meteorological situation for pea development (higher twenty-four-hour average air temperatures and declining rainfall).

Considering the average data (first and second sampling) in sowing terms it was ascertained that the maximum tubers number (26.62 g/plant) and root dry weight (1.55 g/plant) is formed in the second sowing period (10-15 October) and greatest amount of post-harvest residues (435.5 kg/ha) is the third sowing time.

The agrochemical analysis of the soil showed pronounced trends in the content of mineral nitrogen and organic carbon under the influence of different sowing periods (Table 2). An impression is created about the mineral nitrogen ammonium form accumulation in greater stage at the expense of the nitrate form. Increased total content of mineral nitrogen compared with the control variant is due to the agro background in growing pea. The soils, where are harvested the plants from later sowing time are characterized by high nitrogen and carbon content determined possibly by the greater root volume and post-harvest residues in these terms.

Actual and potential soil acidity is in the range of neutral to slightly alkaline. After the pea harvest its values decreased by 2.7 and 5.5 percent compared with the control variant.

4. Conclusion remarks

The different sowing dates in growing wintering fodder pea have an influence on the development of the root mass, tuber-formation, the amount of post-harvest residues and agro-chemical composition of the soil. In the first sampling maximum tubers number (26.62 g/plant) and root dry weight (1.55 g/plant) plants formed in the second sowing period (10-15 october), but the greatest amount of post-harvest residues (435.5 kg/ha) have those in the third period (25-30 october). In the second sampling the indicators value are lower by 76.2, 30.2 and 61.6%.

Agrochemical soil analysis shows well expressed trends in mineral nitrogen and organic carbon content under the influence of different sowing periods. Soils, where are harvested the plants from later sowing time are characterized by high nitrogen and carbon content determined by the larger quantity root and post-harvest residues in these terms. After the harvest of pea the current and potential soil acidity values decreased by 2.7 and 5.5 percent in comparison with the control variant.

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Table 1. The effect of different sowing dates and harvest two-mode swaths on tuber-formation, the formation of root mass and content of plant residues in wintering fodder pea - on average for the period

Табела 1. Влијание на различните рокови на сеидба и двократниот откосен режим врз формирањето на грутковите бактерии, на сувата коренова маса и количината на растителните остатоци по жетвата кај зимскиот фуражен грашок (просек 2005 – 2008)

Terms of sowing Рокови на сеидба	Root dry weight, g / plant Сува маса на коренот g/растение	Tuber formation, tuber number / plant Формирање на груткови бактерии Број на грутки/ растение	Post-harvest residues kg/ha Растителни остатоци по жетва kg/ha
	first sampling откос во фенофаза бутонизација		
25-30 September	1.18	26.14	525.7
10-15 October	2.20	45.14	408.5
25-30 October	0.80	13.67	660.8
	second sampling откос во фенофаза целосно цутење		
25-30 September	0.82	4.50	185.8
10-15 October	0.90	8.10	216.6
25-30 October	1.20	7.60	210.1
$LSD_{5\%}$	0.10	2.73	39.66

Table 2. Agrochemical soil analysis – on average for the period

Табела 2. Агрохемиска анализа на почвата (просек 2005 – 2008)

Variants Варијанти	pH		Mineral N mg/1000 g soil Минерален N mg/1000 g почва			P_2O_5 mg/100 g soil P_2O_5 mg/100 g почва	limited C ограничен C
	H_2O	KCl	NH_4-N	NO_3-N	sum сума		
control* Контрола*	**8.07**	**7.38**	**0.47**	**0.15**	**0.62**	**6.83**	**1.00**
25-30.09	8.08	7.30	11.48	3.92	15.40	6.63	1.04
10-15.10	7.42	6.34	13.44	6.16	19.60	6.82	1.36
25-30.10	8.04	7.27	13.48	7.14	20.62	8.86	1.37

On average for the three sowing period Просек за трите сеидбени рокови	**7.85**	**6.97**	**12.80**	**5.74**	**18.54**	**7.44**	**1.26**

* - the control is without fertilization, no plants
* - контролата е без ѓубрење, без растенија