EFFECT OF FARMING SYSTEMS AND SOIL TILLAGE IN CROP ROTATION ON THE POTENTIAL WEEDINESS OF SUGAR BEET FIELDS

Tanchik S., doctor of agricultural science
Petrenko I., post-graduate student
National University of Life and Environmental Sciences of Ukraine

The results on the effect of cropping systems and basic soil tillage on potential weediness formation in crops of sugar beets. It was found that the industrial and ecological farming systems reduce the potential weediness of sugar beet fields during the vegetation period, and the biological system increases the amount of weed seeds in the soil. Among the basic soil cultivation were the best plow- nonmoldboard and differentiated.

Keywords: *farming systems, soil tillage, sugar beets, weeds, potential weediness, agrophytocenosis, yield.*

Potential reserves of weed seeds in arable soil layer is the main factor that determines the actual weediness of crops. That's why the monitoring of potential weediness of agricultural land should be given constant attention, both scientists and practitioners [5].

According to the Ukrainian scientists [2, 7, 6], a potential weediness in different farms varies and constitutes from several hundred to several billion seeds per 1 ha of arable soil layer, which significantly exceeds the number of sown seeds of cultivated plants. Therefore, plants need help in competing with weeds.

Analysis of potential weediness of the arable soil layer (0-30 cm) in farms of 17 Ukraine regions in different soil-climatic zones showed that in areas with sufficient moisture reserves of weed seeds average of 1.47 billion pieces/ha, unstable

---

* Scientific adviser - professor S. P. Tanchik

wetting –1.71 billion pieces/ha, insufficient moisture – 1.14 billion pieces/ha [8].

Such soil weediness of weed seeds can result in significant actual weediness of crops with reduced crop yields for 25-30%. At the same time it is necessary to consider the kind of the weediness, biological characteristics and prevalence of the most persistent weeds [3].

It is especially important to direct weed control methods to prevent skidding into fields and the distribution of seeds or vegetative seedlings of weeds, reducing its reproduction and the presence of agricultural tools used in cultivation technologies of agricultural crops [9].

The purpose of research was to identify the impact of farming systems and basic soil tillage on regularities of weed seeds accumulation in soil in the field of sugar beet.

The materials and methods of research. Experimental researches were during 2012–2013 in sugar beet crops located in a link with pea, conducted in a stationary experiment of the department of agriculture and herbology on "Agronomic Research Station" of NULES of Ukraine (Pshenychne, Kyiv region).

Soil cover research areas typical black soil humus. The humus content in the plow layer soil is 4%, pH - 6.8, absorption capacity is 32,5 mh-ekv/100 g soil. Groundwater located at a depth of 5-6 m.

The value of weed seeds in arable soil layer was determined by the method described by Y.P. Manko [1].

Scheme of crop rotation is typical for forest-steppe conditions: lucerne – winter wheat – sugar beet – corn for silage – winter wheat – maize – pea – winter wheat – sugar-beet – barley with sowing of lucerne.

Stationary experiment founded in 2001, and observations conducted after 11 years of the beginning of research on farming systems.

Variants of the stationary experiment are located by split plots method. Repeated of experiment – are four times, accommodation variants in repetition – regular. Plots of first order with variants of soil tillage had 280 m², accounting - 225

m². The plots of the second order applied system of fertilization and plant protection. Plots area was 93.6 m², accounting - 75 m².

Scheme of stationary experiment

Variant	Farming systems	Basic soil tillage systems
1	Industrial (control)	Differentiated (control)
2		Subsurface ploughing
3		Periodical mouldboard tillage
4		Superficial
5	Ecological	Differentiated (control)
6		Subsurface ploughing
7		Periodical mouldboard tillage
8		Superficial
9	Biological	Differentiated (control)
10		Subsurface ploughing
11		Periodical mouldboard tillage
12		Superficial

Graduation of the first factor (A) is system of agriculture. They are composed based on their resource supply for the reproduction of soil fertility:

Industrial (control) is the priority use of industrial agrochemicals for the reproduction of fertility of soil, bringing on a 1 hectare of area of crop rotation of 24 t organic fertilizers, 300 kg of NPK of mineral fertilizers and intensive application of pesticides for protecting of sowing from harmful organisms;

Ecological is the priority use for the reproduction of soil fertility of organic fertilizers. Bringing on a 1 hectare of area of crop rotation of 24 t organic fertilizer (12 t leave to rot, 6 t of not commodity part of harvest, 6 t mass of green manure), and 150 kg of NPK of mineral fertilizers. In addition, complex biological seed treatment, by application of chemical preparations after the criterion of ecological and economical threshold of presence of harmful organisms;

Biological – application only of natural resources is 24 t/ha organic fertilizers for the reproduction of soil fertility without bringing of industrial agrochemicals, use of complex bio preparation for treatment of seed and biological facilities of defence of sowing.

The system of soil tillage in crop rotation in each model of agriculture presented in four variants: differentiated (control) with the execution six different deep ploughings during rotation, two disking on 8–10 cm under winter wheat after

peas and silage corn and one land clearer cultivation during barley; subsurface ploughing – different deep subsurface plough soil loosening under all crops except the surface tillage under winter wheat in the fields listed in the control; periodical mouldboard tillage: includes ploughing under sugar beet, surface cultivation under winter wheat in the fields listed in the control and subsurface ploughing under other crops; superficial: disking to a depth of 8–10 cm for all crops.

Statistical analysis of the data was determined by the method described by B. A. Dospehov [4].

The results of the research. A significant reduction of potential weediness of arable layer is the main strategy for the effective protection of crops from weeds. So important is the assessment of the ability of the farming system to effectively control of potential weediness of crops.

Layer-by-layer determination of the potential weediness of sugar beet in the experience allows you to take it to a high variation in the number of physically normal weed seeds in the soil layer 0-30 cm [1]. According to embodiments of the experience of this indicator before sugar beet sowing it is ranged from 281 to 525 million pieces/ha, before harvesting - 238-456 million pieces/ha.

During the consideration of viable weed seeds washed from soil samples collected in the sugar beet crop before sowing in the arable soil layer (0 - 30 cm) cropping systems on average, the highest potential weediness identified in the biological farming system - 441 million pieces/ha seeds, the ecological - 356 million pieces/ha, and the lowest in the industrial 324 million pieces/ha.

For basic soil tillage system the average number of weed seeds in the arable soil layer was the highest in superficial soil tillage - 444 million pieces/ha, differentiated - 367 million pieces/ha, subsurface ploughing -359 million pieces/ha and the lowest periodical mouldboard - 322 million pieces/ha.

It is important to assess the number of weed seeds in the soil layer (0-10 cm), from which appearing shoots. It should be noted that for the nonmoldboard tillage in the surface layer (0-10 cm) was about 46 - 51% of all stocks of weed seeds in the arable soil layer, whereas for of moldboard tillage - 25 – 34% (Fig. 1).

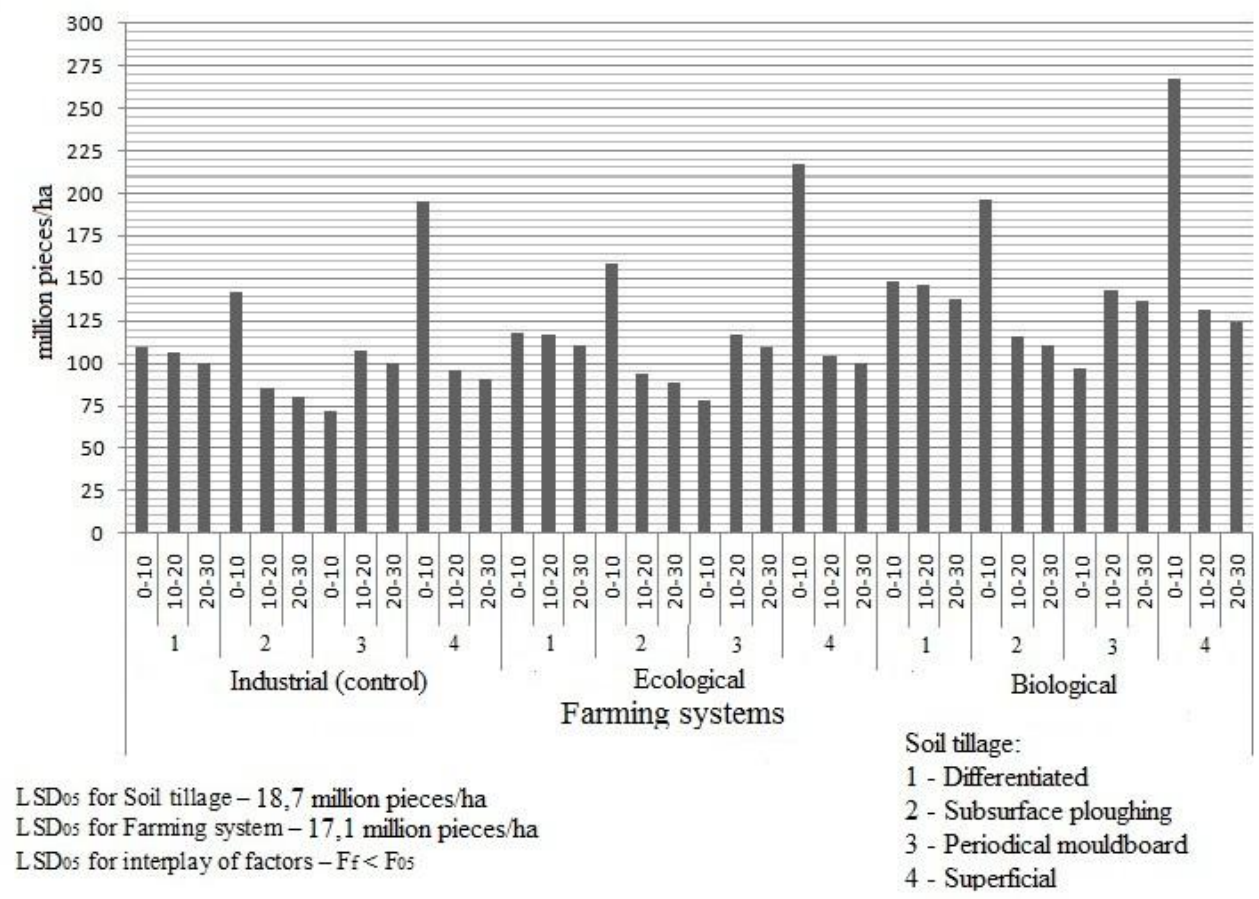

Fig. 1. Effect of cropping systems and basic soil tillage on potential weediness of sugar beet crops before sowing (average for 2012-2013).

During the harvesting of culture on all variants of industrial and ecological farming systems the number of viable weed seeds in the surface soil layer during the growing season of the crop decreased on average respectively 17.6 and 14.5%, and biological systems increased by 3.5%.

Therefore, when combined periodical mouldboard tillage with industrial farming system the number of weed seeds in the soil at the end of the growing season of sugar beet was 25 % less compared to its beginning. Related results were obtained for the combination of the industrial farming system with differentiated tillage (22,7%). Biological systems combination with subsurface ploughing increased potential weediness of the arable soil layer by 5.6 % (Fig. 2).

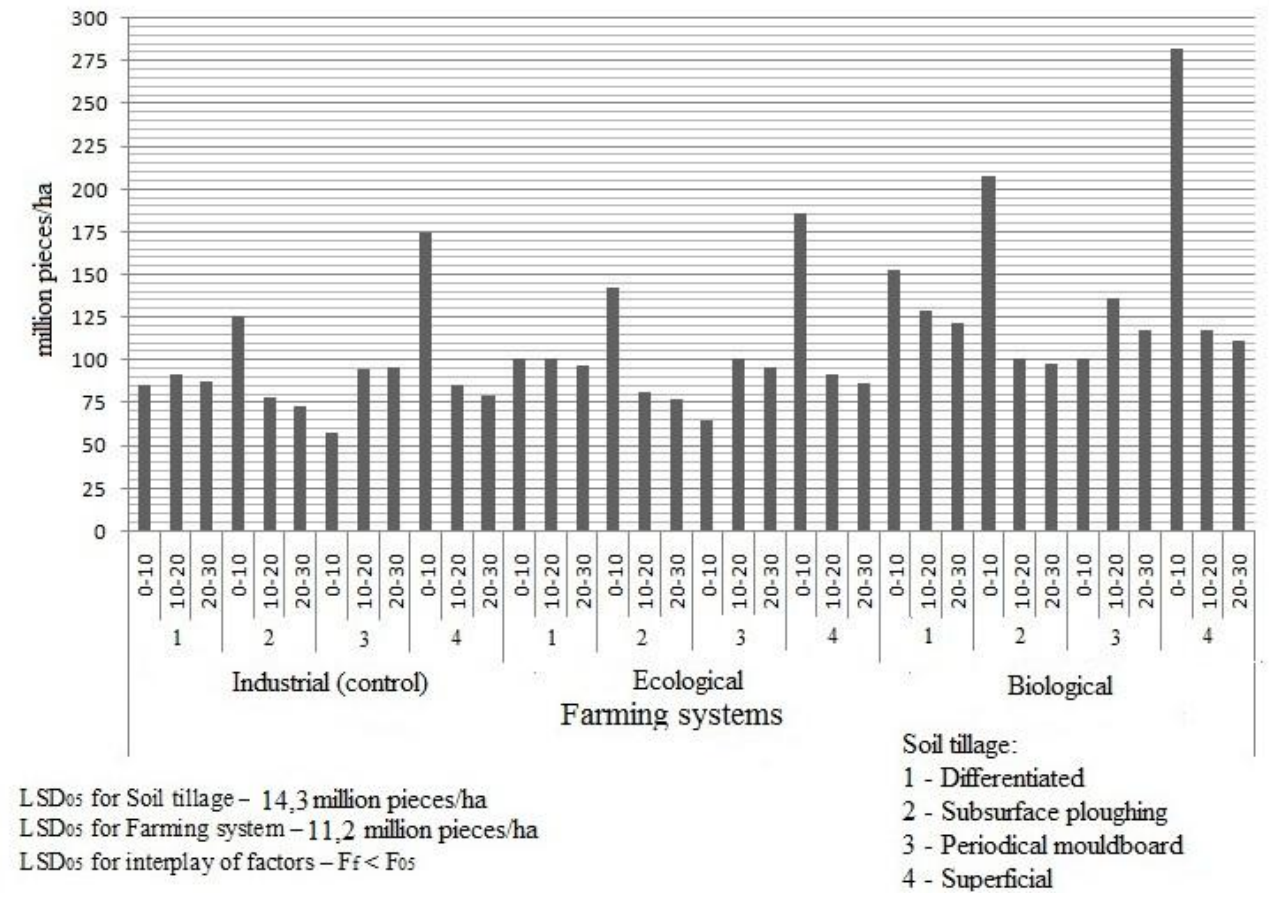

Fig. 2. Effect of cropping systems and basic soil tillage on potential weediness of sugar beet crops before harvest (average for 2012-2013).

This has made the connection in considering the yield of sugar beet. The highest yield of sugar beet achieved on the background of the application periodical mouldboard tillage with industrial systems - 84 t/ha. In variant biological farming system received significantly lower yields compared to industrial and ecological systems. This is due to the significant increase in potential and actual weediness at biological farming systems for complete renunciation of chemical control in comparison with its industrial and ecological models (Fig. 3).

Research has shown that between the value of potential weediness and yield of sugar beet crops, there is a strong inverse correlation (r=-0,9).

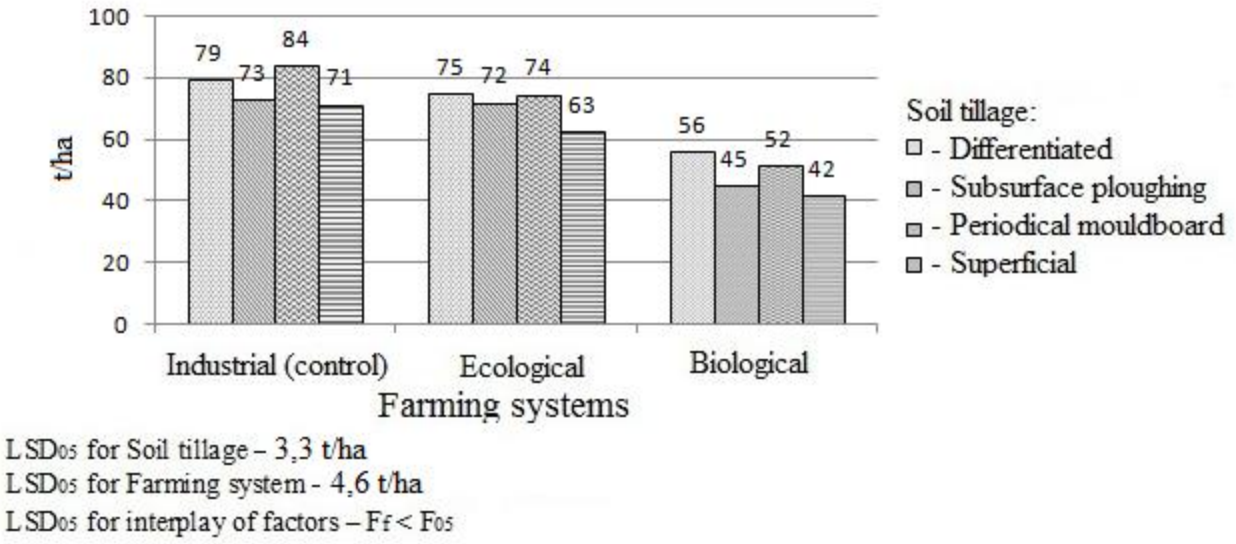

Fig. 3. The yield of sugar beet depending on cropping systems and basic soil tillage (average for 2012-2013).

Conclusions. 1. The largest decrease of potential weediness of sugar beet crops during the vegetation period obtained by industrial and ecological farming systems. Biological farming system contributes to the accumulation of weed seeds in the surface soil layer due to the high actual weediness of crops, which reduces the yield. 2. Among the basic soil tillage, the best were periodical mouldboard tillage and differentiated. 3. The best option was experience with periodical mouldboard tillage on the background of the industrial farming system, in which the number of weed seeds in the soil decreased by 25%, which contributed the greatest yield - 84 t/ha. 4. Revealed a strong inverse correlation (r=-0,9) between the value of yields of sugar beet crops from the potential weediness of arable land before sowing.

References

1. Бур’яни та заходи боротьби з ними / [Манько Ю. П., Веселовський І. В., Орел Л. В., Танчик С. П.]. — К.: Учбово-методичний центр Мінагропрому України, 1998. — 240 с.

2. Веселовський І. В. Контроль бур’янів у посівах сільськогосподарських культур і технологія виробництва продукції рільництва / І. В. Веселовський, С. П. Танчик // Науковий вісник НАУ. – 1997. – Вип.1. – С. 71 – 75.

3. Груздев Г. С. Актуальные вопроси борьбы с сорными растениями / Г. С. Грудзев. – М. : Колос, 1980. – 250 с.

4. Доспехов Б. А. / Методика полевого опыта – М., Колос, 1979. – 416 с.

5. Манько Ю. П. Потенційна засміченість поля / Ю. П. Манько // Захист рослин. – 2000. – № 4. – С. 6.

6. Манько Ю. П. Зниження потенціальної засміченості ріллі / Ю. П. Манько // Вісник аграрної науки. – 1991. – № 8. – С. 20 – 23.

7. Манько Ю. П. Проблема потенційної забур'яненості ріллі та напрямки її вирішення в землеробстві / Манько Ю. П. // Особливості забур'янення посівів і захист від бур'янів у сучасних умовах : конференція українського товариства гербологів. – К. : Світ, 2000. – С. 18 – 19.

8. Наші завдання сьогодні / О. О. Іващенко // Забур'яненість посівів та засоби і методи її знищення : матеріали конференції. – К.: Світ, 2002. – С. 3 – 6.

9. Сторчоус І. М. Стратегія і тактика контролю забур'яненості / І. М. Сторчоус // Агробізнес сьогодні. – 2011. – №14. – С. 15.

Вплив систем землеробства та основного обробітку грунту в сівозміні на потенційну забур'яненість полівбуряків цукрових

Танчик С. П., Петренко І. М.

Наведено результати досліджень щодо впливу систем землеробства та основного обробітку ґрунту на формування потенційної забур'яненості ґрунту в посівах буряків цукрових. З'ясовано, що промислова та екологічна системи землеробства знижують потенційну забур'яненість полів буряків цукрових за період вегетації, а біологічна система сприяє збільшенню насіння бур'янів у грунті. Серед основних обробітків ґрунту кращими виявилися полицево-безполицевий та диференційований.

Ключові слова: *системи землеробства, обробіток ґрунту, буряки цукрові, бур'яни, потенційна забур'яненість, агрофітоценоз, урожайність.*

Влияние систем земледелия и основной обработки почвы в севообороте на потенциальную засоренность полей сахарной свеклы

Танчик С. П., Петренко И. М.

Приведены результаты исследований влияния систем земледелия и основной обработки почвы на формирование потенциальной засоренности почвы в посевах сахарной свеклы. Выяснено, что промышленная и экологическая системы земледелия снижают потенциальную засоренность полей сахарной свеклы за период вегетации, а биологическая система способствует увеличению семян сорняков в почве. Среди основных обработок почвы лучшими оказались плужно-безплужная и дифференцированная.

Ключевые слова: *системы земледелия, обработка почвы, сахарная свекла, сорняки, потенциальная засоренность, агрофитоценоз, урожайность.*