UDC:631.527:633.34:631.6(477.72)

REGRESSION AND CORRELATION ANALYSIS OF SOYBEAN PRODUCTIVITY ELEMENTS

Lavrynenko Y.O. *– Doctor of Agricultural Sciences, Professor, Member of National Academy of Agricultural Sciences of Ukraine*
Kuzmych V.I. *– Research Associate*
Klubuk V.V. - *Research Associate, Institute of Irrigated Agriculture of NAAS*

У статті висвітлено результати вивчення кореляційних залежностей між основним показником продуктивності сої – масою насіння з рослини та іншими кількісними ознаками. Виділено ознаки, які можуть бути селективними при проведенні доборів на продуктивність. Побудовано рівняння регресії для визначення маси насіння з рослини через показники числа продуктивних вузлів на рослині та числа бобів з рослини. Запропоновано математичну модель залежності маси насіння від числа продуктивних вузлів і бобів на рослині.

Ключові слова: *соя, маса насіння з рослини, число продуктивних вузлів на рослині, число бобів на рослині, кореляція, рівняння регресії, математична модель, добори, продуктивність.*

Лавриненко Ю.О., Кузьмич В.И., Клубук В.В. Корреляционно-регрессионный анализ элементов продуктивности сои

В статье изложены результаты изучения корреляционных зависимостей между основным показателем продуктивности сои – массой семян с растения и другими количественными признаками. Выделены признаки, которые могут быть селективными при проведении отборов на продуктивность. Построены уравнения регрессии для определения массы семян с растения через показатели числа продуктивных узлов на растении и числа бобов на растении. Предложена математическая модель зависимости массы семян от числа продуктивных узлов и бобов на растении.

Ключевые слова: *соя, масса семян с растения, число продуктивных узлов на растении, число бобов на растении, корреляция, уравнение регрессии, математическая модель, отборы, продуктивность.*

Introduction. Soybean is the most important crops in the world, that used to satisfy the needs of vegetable protein and soybean oil production. Soybean products are used in medicine so much [1]. Priority aim is to cultivate highly productive and high-quality cultivars that will be adapted to particular condition of farming and to grow up the farming area of soybean in the steppe area [2].

The priority task for selectionist is to increase soybean productivity hence the great number of domestic and international scientific articles are devoted to this issue [3-6]. The traits of productivity are quite uncertain therefore it is important to have the data about regularity of it simultaneous uncertainty to make the prognosis of effective selection based upon complex of traits [7].

Problem statement. Several Researches made a correlation analysis of association between productivity and other variables, that may be determined as selective one. Some researchers assessed stable association (r=0,54-0,99) between seeds productivity and weight of the soybean plant. However association between number of nodes is variable by character of vegetation years and maturity groups from r=0,10 in the late-ripening group up to r=0,92 in the mid-ripening group of soybeans cultivars [8]. Some sources assessed about significant positive correlations between

yield of the seeds and number of nodes as well as about number of nodes per plant character as criteria for soybeans productivity selection [9].

Contribution of one quantitative trait to productivity formation is not the same for different genotypes and climate conditions. Therefore this make grounds for research of correlation between productivity and soybeans quantitative traits.

Materials and methods. The purpose of our research was to apply regression and correlation analysis to determine the traits that may work as markers for soybeans productivity selection.

Researches were carried in soybeans hybrid and selection seed plots of Institute of Irrigated Agriculture of NAAS within 2007-2009. Base crops for research were hybrid population F_2–F_5 (Yug 40 / Faethon, Yug 40 / Tresor, Yug 40/Lambert, Yug 40/ Arkadia odeska, Danaia/Faeton, Faeton / SM 158, Diona / 1052(5)96, Izumrudna /Tresor, Yug 40/ Banana, BY 5823 / Altair, Vityaz 50/ Banana and 1814(2)90 / KS 9) soybeans selection numbers F_3–F_5 and their male forms.

Planting was carried in optimal terms – in the first half of May into depth of 5-6 cm by selective seeding-machine SKS-6-10 and cassette seed distributor by regular selection sowing. One row sows with 0,45 row-spacing, area of the plot is 2,25 m^2. After every 9 number the standard Yug 40 was sowed. Female and male forms were planted between hybrid combinations. Research of perspective numbers were carried by standard methodic.

Correlation coefficients assessing and regression quantification were made in Excel. Average correlation coefficient computing for quantitative traits was made by G.W. Snedecor methodic [10].

Scale of B.A. Dospehov has been applied to quantify the strength of association: $r < 0,3$ correlation between variables is weak; $r = 0,3$-$0,7$ correlation between variables is middle; $r > 0,7$ correlation between variables is strong.

Results. Seeds weight per plant is major trait for soybeans productivity. After the years of F_3-F_5 soybean hybrids research linear average correlations has been assessed between seeds weight per plant and stem thickness – r=0,513, thickness of stem base – r=0,687, number of branches per plant – r=0,558 and number of productive nodes at main stem – r=0,618 (fig. 1).

The strong positive relation was observed between seeds weight per plant and following quantitative traits: number of productive nodes on branches – r=0,810, number of productive nodes per plant-r=0,861, number of beans per plant – r=0,939, number of seeds per plant – r=0,965, weight of the plant – r=0,956; seeds weight per plant – r=0,993.

Considering that strong linear correlation (r=0,861) between seeds weight per plant and number of productive nodes per plant has been established, and considering that of latter trait is visually comfortable for determination in the field conditions the regression equation was made: $y=0,0975x^{1,5279}$, determination coefficient – R^2 = 0,742, where y - seeds weight per plant, g; x - number of productive nodes per plant (fig. 2). Simultaneously the strong linear association between seeds weight and number of beans per plant (r=0,939) is observed, additionally this trait can be determined easily on the plant in the field conditions. Therefore another regression equation was made: $y=0,0997x^{1,229}$, determination coefficient – R^2 = 0,924, where y - seeds weight per plant, g; x - number of beans per plant (fig. 3).

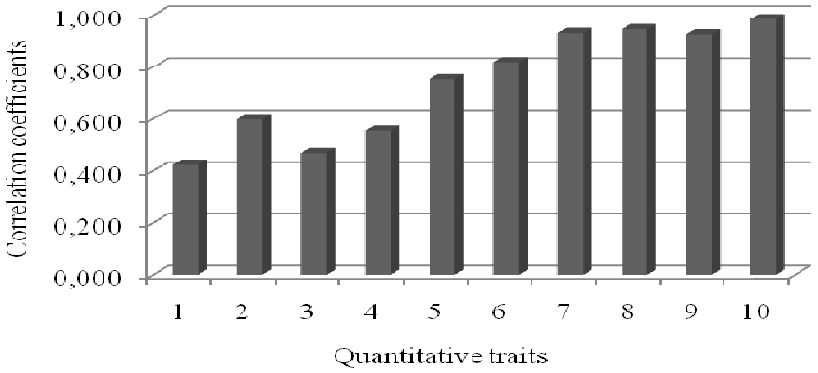

Fig. 1 Average correlation between seeds weight and other quantitative traits for F_3-F_5 soybean hybrids

1- stem thickness; 2- thickness of stem base; 3- number of branches per plant; 4- number of productive nodes at main stem; 5- number of productive nodes on branches; 6-number of productive nodes per plant; 7- number of beans per plant; 8- number of seeds per plant, 9-weight of the plant; 10 – seeds weight per plant

Note. Correlation coefficients are significant on the level of 0,05

Since both equations are made for seeds weight per plant variables we can make a system of equations with help of mathematical rules. We will denote number of productive nodes per plant character by z for our convenience. Than:

$$\text{Where: } \begin{cases} y = 0{,}0975z^{1{,}5279} \\ y = \dfrac{0{,}0997x^{1{,}229}}{2y = 0{,}0975z^{1{,}5279} + 0{,}0997x^{1{,}229}} \end{cases}$$

$$y = \frac{0{,}0975z^{1{,}5279} + 0{,}0997x^{1{,}229}}{2}$$

$$y = 0{,}04875z^{1{,}5279} + 0{,}04985x^{1{,}229}$$

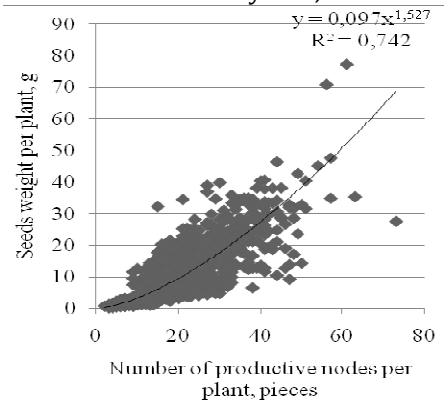

Fig. 2 Mathematical association between seeds weight per plant and number of productive nodes per plant

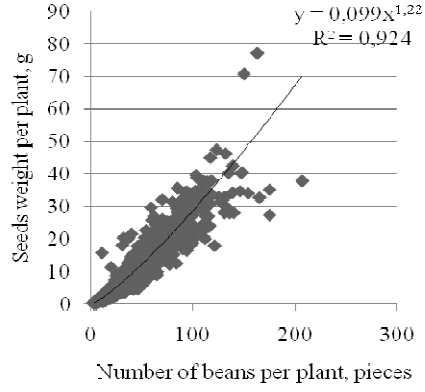

Fig. 3 Mathematical association between seeds weight per plant and number of beans per plant

Therefore we make mathematical model that determines the association between seeds weight (y), number of productive nodes (z) and number of beans per plant (x) that summarized in the Figure 4. This model will select much productive plants in the field conditions before beans thrashing.

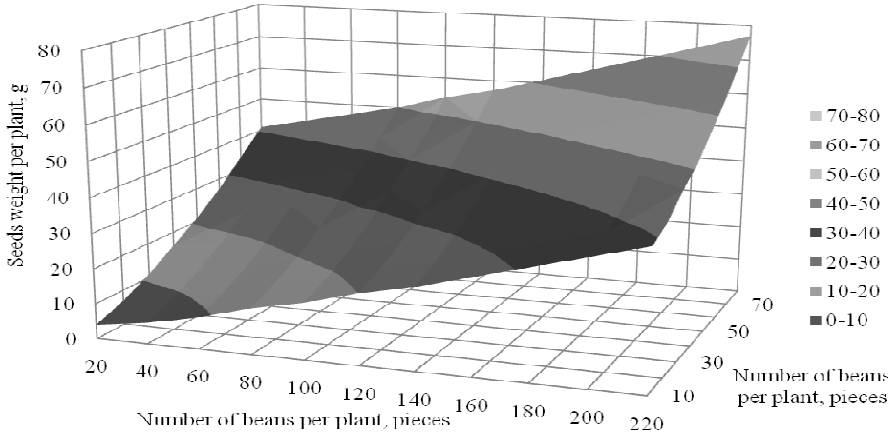

Fig. 4 Mathematical model that determine the association between seeds weight (y), number of productive nodes (z) and number of beans per plant (x)

Conclusions. 1. It is determined positive average correlation between seeds weight and stem thickness – r=0,513, thickness of stem base – r=0,687, number of branches per plant – r=0,558 and number of productive nodes on main stem – r=0,618.

2. Strong linear association was observed between seeds weight per plant and following quantitative traits: number of productive nodes on branches – r=0,810, number of productive nodes per plant – r=0,861, number of beans per plant – r=0,939, number of seeds per plant – r=0,965, plant's weight – r=0,956 and seeds weight per plant – r=0,993. These traits may be considered as factorial and should be used for selection of soybeans productivity increase.

3. Our mathematical model that determines the association between seeds weight, number of productive nodes and number of beans per plant will make easy selection for soybeans productivity increase in the field conditions.

REFERENCES:

1. Бабич А.О. Сучасне виробництво і використання сої /А.О. Бабич. – К.: Урожай, 1993. – 429 с.
2. Медведєва Л.Р. Результати і перспективи селекції сої у Кіровоградському інституті АПВ / Л.Р. Медведєва, О.О. Холковська // Збірник наукових праць СГІ-НЦНС. – Одеса, 2010. – Вип. 15(55). – С. 94-100.
3. Шерепітко В.В. Селекція сої на Поділлі / В.В. Шерепітко, Н.А. Шерепітко // Вісник аграрної науки. – 2000. - № 10. – С. 34-36
4. Шерепітко В.В. Новий сорт сої Подільська 416 / В.В. Шерепітко // Вісник аграрної науки. – 2009. – № 9. – С. 71.

5. Шерепітко В.В. Високопродуктивний сорт сої Подільська 1 / В.В. Шерепітко, О.О. Созінов, А.О. Бабич, В.Ф. Петриченко, А.Й. Антохов, Н.А. Шерепітко, Г.О. Болоховська, С.П. Крітенко, О.Б. Будак, А.Г. Глущак // Аграрна наука – виробництву. – 2001. – № 2. – С. 8.
6. Petrychencko V. Soybean: State and perspective of the development in the Ukraine / V. Petrychencko, A. Babych, S. Ivanyuk, S. Kolisnyk, V. Zadorozhnyi // Legume Perspectives. – 2013. – Issue 1. – P. 37.
7. Орлюк А. П. Теоретичні основи селекції рослин / Орлюк А. П. – Херсон: Айлант, 2008. – 572 с.
8. Коханюк Н. В. Оцінка сортозразків сої на основі кореляції кількісних ознак та індексів / Н. В. Коханюк // Вісник ЦНЗ АПВ Харківської області. – 2014. – Вип. 17. – С. 112-116.
9. The effect of selection method on the association of yield and seed protein with agronomic characters in an interspecific cross of soybean [Електронний ресурс] / L. Xinhai, W. Jinling, Y. Qingkai, J. Shaojie, W. Liming // Soybean Genetics Newsletter. – 1999. - № 26. – Режим доступу до журн.: http://www.soygenetics.org/articles/sgn1999-002.html.
10. Снедекор Дж. У. Статистические методы в применении к исследованиям в сельском хозяйстве и биологии / Дж. У. Снедекор. – М: Сельхозиздат, 1961. – 503 с.
11. Доспехов Б. А. Методика полевого опыта (с основами статистической обработки результатов исследований) / Доспехов Б. А. – М.: Агропромиздат, 1985. – 351 с.

UDC: 631.6: 635.25: 631.8 (477.72)

SCIENTIFIC AND PRACTICAL SUBSTANTIATION OF THE CULTIVATION TECHNOLOGY OF CORN HYBRIDS UNDER DRIP IRRIGATION

Lavrynenko Y.O. *– Doctor of Agricultural Sciences, Professor, Corresponding Member of NAAS*
Snihovyi V.S. *– Doctor of Agricultural Sciences, Professor, Corresponding Member of NAAS*
Kokovikhin S.V. *– Doctor of Agricultural Sciences, Professor, State higher education institution «Kherson State Agricultural University»*

В статті наведено результати досліджень з гібридами кукурудзи при її вирощуванні в системах краплинного зрошення. Доведена можливість формування економічно вигідних урожаїв зерна культури на рівні 16-18 т/га при густоті стояння рослин 80-90 тис./га. Найкраща окупність азотних добрив зафіксована за внесення $N_{120}P_{90}$.

Ключові слова: *краплинне зрошення, гібриди кукурудзи, густота стояння рослин, азотні добрива, густота стояння рослин, економічна ефективність.*

Лавриненко Ю.А., Снеговой В.С., Коковихин С.В. Научно-практическое обоснование технологии выращивания гибридов кукурузы при капельном способе орошения

В статье приведены результаты исследований с гибридами кукурузы при ее выращивании в системах капельного орошения. Доказана возможность формирования эко-