

## THE EFFECT OF PLANT DENSITY ON THE PRODUCTIVITY OF SUNFLOWER HYBRIDS IN THE SOUTH OF UKRAINE

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Investigation

*The dependence of hybrids seed production bred in Plant Breeding and  
Genetics National Centre of Academy of Agricultural Sciences of Ukraine from  
various plant density and the weather conditions of the growing seasons in the years  
of research has been studied.*

**Keywords:** sunflower, hybrid, seeding rate, density, yield.

**Introduction.** On average during the last 5 years in Ukraine sunflower cultivation has occupied about 15% of all cultivated areas. The share of sunflower in oilseed production during this period has amounted to more than 70%. However, now the situation is changing. Last year, the share of sunflower in the structure of the sowing area of industrial crops did not exceed 63% and tends to decrease [1].

The vast majority of grown seeds were processed in domestic oil and fat factories, with implementation in foreign markets. Last year it was produced 3.1 million tones of oil, of which sunflower oil – 3 million tons. Export amounted to 2.7 million tones, or 90% of total production. However, despite the well-developed industrial infrastructure annually up to 10% of the sunflower crop is exported without previous processing. Therefore, the global market has a great effect on the domestic industry [2].

Unlike Ukraine in world agriculture sunflower seeds do not belong to the major oilseed crops, although take a significant place in oil balance. The production volumes of sunflower yield to such oilseed crops, like soybean and rape. The world production of oilseeds in 2010-2013 averaged 450 million tones. In this case, the total yield proportion of soybeans was 57%, rape - 13%, sunflower - 8%.

According to the USDA data, in 2011-2012 MP Ukraine together with the EU-27 occupied the second place of the world rating of sunflower producers.

The structure of sunflower seeds world exports can be distributed as follows: EU-27 - 22%, Ukraine - 42%, Russia 1%, Argentina - 3%. Other countries account for 32% of the world sales. Generally the share of sunflower exports on volumes of its consumption is only 6%, due to the satisfaction of the world consumer needs not in raw materials but in processed products, which are mostly edible oil and oilseed meal.

There is a favorable price situation for agricultural enterprises evidenced by high purchase prices in the domestic market of sunflower in Ukraine. At the end of August sunflower seeds were bought at average of 4.9-5.0 thousand UAH/t, which is half more prices against the corresponding period of the last year. However, association "Ukroliyprom" awaits the cost reduction of up to 4 thousand UAH/t at the beginning of harvesting period. It is reasonable prognosis, because the increase of supply in the market, the desire to sell product quickly in order to finance the harvesting only contribute to the cheapening of the seeds.

Such prices do not fully meet the interests of agricultural producers, because there has been a significant rise in price of material and technical resources. During the current spring sowing ammonium nitrate has cost 3.4 thousand UAH/t, which is half as expensive in comparison to the last season. ANP fertilizer has increased in price by more than a third, reaching 4.3 thousand UAH/t. The cost of fuel and lubricants has risen by nearly half and stopped at the mark of 10.2 thousand UAH/t. Considering the technological costs, the sunflower cultivation in 1 ha costs the farmers 5.5 thousand UAH. Only for recoument of incurred costs, taking into account the purchase price of 4 thousand UAH, it is necessary to have the yield of 13.8 c/ha. Consequently, with an average yield of 15.7 c/ha the level of sunflower profitability will be 15%.

Nobody can predict how sustainable will be the price situation in prospect. But the price of oil raw materials will mainly depend on the cost of oil. If oil prices continue to fall, they will also pull down the prices of oilseeds. Taking into account the existing trend, farmers may wait for the price that will satisfy them. But you should understand that after getting the desired you can win or lose.

In favor of producers is the fact that the production possibilities of domestic oil and fat factories have increased to 10.3 million tones per year. Therefore, competition in domestic raw materials market will escalate. Its existence may lead to the gradual increase in the production cost, but the price level will depend primarily on the situation in the global market. Thus, the growth of world prices can lead to increasing costs in domestic market.

Taking into account the forecast of industry development it will be important not only to improve continuously the quality of technological operations of sunflower cultivation and also to breed high-yielding hybrids.

**Problem definition.** In sunflower hybrids breeding the priority guidelines were and still remain the studies aimed to improving performance, resistance to adverse climatic conditions, pathogenic agents and pests, maximal adaptiveness to intensive technologies of cultivation.

However, considering the different hybrids requirements to soil fertility, lighting and water consumption it is necessary to pay attention to the choice of the optimal plant density of each hybrid.

**Materials and methods of research.** Field experiments were conducted in 2012-2013 in the fields of experimental facilities PBGI - HCSCI "Dachna".

The humus content in the topsoil of experimental plots ranged 4,13 - 4,38 %, the reaction of the soil solution was close to neutral with pH - 7.2. The weather conditions in the years of research differed in the level of soil humidity and distribution of rainfall during the growing season, giving versatile possibilities to trace the reaction of studied sunflower hybrids.

In the experiment 11 sunflower hybrids were studied: Rehion, Zhoda, Vivat, Siuzhet, Bazalt, Oreol, Sibson, Hector, Yason, Darii, Slavson, Antratsit. The seeding rates of each hybrid were 45, 55 and 65 thousand of seeds per 1 hectare, at the width of row spacing 75 cm. Among the studied hybrids there are already widely known and occupying large acreage in the South of Ukraine - Zhoda, Darii, Yason and new promising Rehion, Vivat, Siuzhet, Bazalt, Oreol, Sibson, Hector, Slavson, Antratsit.

Agrotechnics of the experiment was common to the southern steppe area. Plots had four rows, hybrids were sown in randomization blocks with four replications.

Accounting area of the plot is 10 m, the plant density was formed manually in the phase of 2-4 leaves of sunflower.

**The research results.** Summarizing the obtained data(table 1), we can state a certain sensitivity of sunflower bredin PBGI - HCSCI to plant density. So in the weather conditions of 2012, the highest average yield hybrids showed at density of 65 thousand/ha - 2.48 t/ha. When the plant density was lower - 55 and 45 thousand/ha, respectively decreased the average sunflower seed production to the level of 2.28 and 2.31 t/ha.

**Table 1**

**The dependence of the seeds yield of sunflower hybrids from plant density and the weather conditions of the year, t/ha**

Hybrid	2012			2013		
	Plantdensity, thousand./ha			Plantdensity, thousand./ha		
	45	55	65	45	55	65
Rehion	1,88	2,40	2,25	2,58	2,28	2,34
Zhoda	2,29	2,33	2,33	2,44	2,31	2,36
Vivat	2,09	2,13	2,41	1,58	1,66	1,74
Siuzhet	2,29	2,21	2,88	2,61	2,74	2,48
Bazalt	2,01	2,73	2,72	2,48	2,56	2,38
Oreol	2,12	2,26	2,44	2,66	2,56	2,42
Sibson	2,28	2,27	2,29	2,56	2,53	2,63
Yason	2,09	2,07	2,26	2,47	2,66	2,67
Darii	2,09	2,18	2,34	2,60	2,71	2,58
Slavson	2,12	2,25	2,65	2,78	2,68	2,68
Anratsyt	2,09	2,25	2,74	2,73	2,55	2,58
X	2,12	2,28	2,48	2,50	2,48	2,44

A somewhat different situation was in 2013 under less favorable weather conditions, when the seed yield despite the different seeding rates was about the same level with a slight tendency to increase at the seeding rate of 45 thousand viable seeds per hectare.

It should be noted that there is no absolute leader among hybrids (Table 2). So under favorable conditions of 2012, we note the high value of the yield of the hybrid Siuzhet at the seeding rate of 65 thousand/ha - 2.88 t/ha that is 0.65 t/ha higher than that of Yason, which can be considered as a standard. In less favourable 2013, the

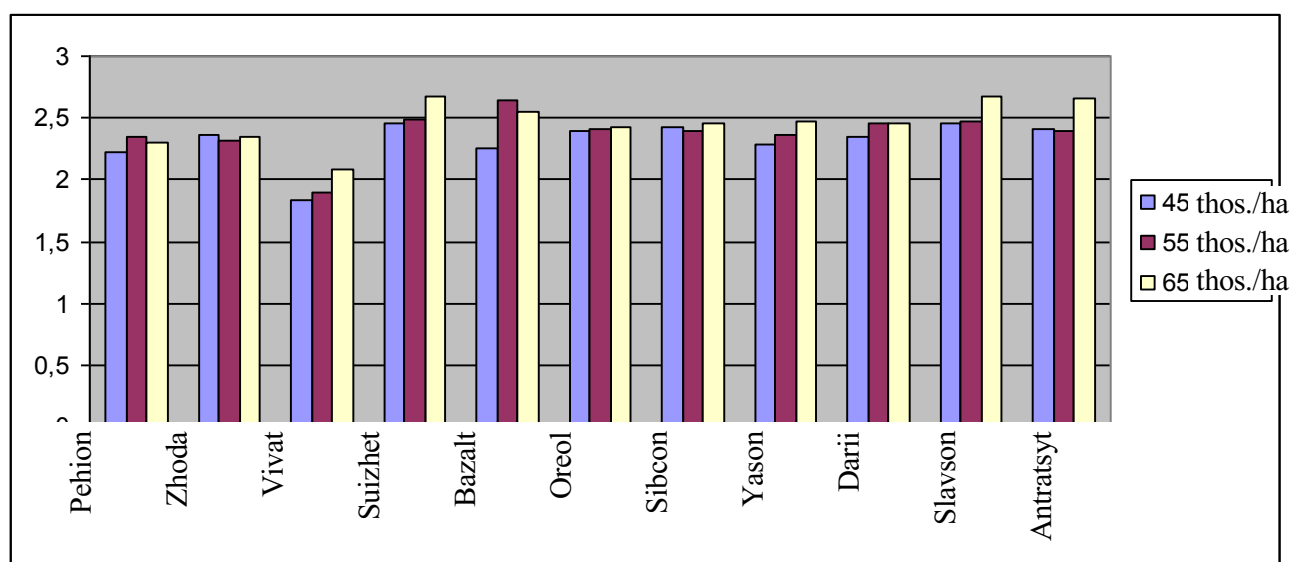
highest yield was recorded in the hybrid Slavson at the seeding rate of 45 thousand/ha – 2.78 ha, 0.47 t/ha more than Yason.

**Table 2**

**The average yield of hybrids at different plant density, t/ha**

Hybrid	Plantdensity, thousand./ha		
	45	55	65
Rehion	2,23	2,34	2,30
Zhoda	2,37	2,32	2,35
Vivat	1,84	1,9	2,08
Siuzhet	2,45	2,48	2,68
Bazalt	2,25	2,65	2,55
Oreol	2,39	2,41	2,43
Sibson	2,42	2,40	2,46
Yason	2,28	2,37	2,47
Darii	2,35	2,45	2,46
Slavson	2,45	2,47	2,67
Antratsyt	2,41	2,40	2,66
X	2,31	2,38	2,46

In the result of research it has been revealed, that different hybrids differ according to response to plant density (Fig. 1).



**Fig. 1. The level of hybrids performance depending on the plant density**

**Conclusions.** So hybrids Zhoda, Oreol, Sibson almost do not react to changes in plant density from 45 to 65 thousand/ha changing the yield - 0,02 - 0,06 t/ha, so we can assume that these hybrids are best grown using the seed rate of 45 thousand

viable seeds per hectare. Darii and Yason have showed the slight increase by 0.11 and 0.19 t/ha. Vivat, Suizhet, Slavson, Antratsyt have increased to 0.20 - 0.25 t/ha, and Bazalt has increased productivity only at density 55 thousand/ha but at 0.4t/ha.

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### Анотація

**І. М. Когут, С. М. Мішин, С. І. Карапіра. Вплив густоти стояння рослин на продуктивність гібридів соняшнику в умовах півдня України.** *Вивчалась залежність насінневої продуктивності гібридів селекції СГ НЦ УААН від різної густоти стояння рослин та погодних умов вегетації в роки досліджень.*

*Ключові слова: соняшник, гібрид, норма висіву, густина стояння, урожайність.*

### Аннотация

**И. Н. Когут, С. Н. Мишин, С.И. Карапира. Влияние густоты стояния растений на продуктивность гибридов подсолнечника в условиях юга Украины.** *Изучалась зависимость семенной продуктивности гибридов селекции СГ НЦ УААН при разной густоте стояния растений и погодных условиях вегетации.*

*Ключевые слова: подсолнечник, гибрид, норма высева, густота стояния, урожайность.*