

**THE FERTILIZERS EFFECT ON CLEAN PRODUCTIVITY OF
PHOTOSYNTHESIS OF SOYABEAN IN CONDITIONS OF DIRECT
SOWING (NO-TILL)**

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The effect of fertilizers on clean productivity of photosynthesis of soybean in conditions of direct sowing was researched. The fertilizers rate $N_{60}P_{60}K_{60}$ has positive effect on plant growth and plant development of soybean during its vegetation. Leave index was 2.83 and maximal. The content of dry matter in plants was 5.77 t/ha and clean productivity of plant photosynthesis was 9.22 g/m². Therefore, the soybean yield was 3.21 t per ha in variant with fertilizers rate $N_{60}P_{60}K_{60}$. The yield surplus was 0.86 t/ha compared to control. In a variant of traditional tillage application, yield surplus was 0.44–1.07 t/ha compared to to direct sowing.

Key-words: soybean, fertilizers, soil tillage, direct sowing (no-till), clean productivity of plant photosynthesis.

Research object: to define optimal optics-biological structure of direct soy sowing system (no-tillage) and nutrition optimization.

Methods of research: Experiments were conducted in 2013-2014 on the experiment field of department of agrochemistry and quality of crop production named after O.Dushechkin of NULES of Ukraine (Kyiv region, Boryspil district). Area of sowing experiment plot was 100m², accounting area was 54 m², triple recurrence.

Soil of experiment plot was Dark Gray Podzolic rough dusty easy loam on loess soil. It was characterized by light acid reaction, low level of mineral Nitrogen, high level of mobile phosphorus and potassium, middle level of exchangeable calcium and magnesium.

Investigation of optics-biological structure of soy field was conducted under application of different doses of nitrogen fertilizer on the background of $P_{60}K_{60}$ and direct sowing and traditional soil tillage methods. Fertilizers doses increased from $N_{20}P_{60}K_{60}$ to $N_{80}P_{60}K_{60}$ with fold increase of N_{20} in the variants.

Tillage variant included: precursor stubble peeling (10–12 cm), autumn plowing (25–27 cm), preplant cultivation (10–12 cm). Minimal tillage included precursor stubble peeling (10–12 cm), preplant cultivation (10–12 cm). Direct seeding included only fertilizers mixing on the depth of 3–4 cm with Vaderstad Carrier 400.

Sowing of seed of Merlin variety was performed with SuperWalter W1770 seeder.

Research results: One of parameters that characterizes growth of leaves growth is leaves index (LI), which indicates amount of leaves per square meter.

Conducted experiments showed that under direct sowing LI decreased, compared to variant under traditional soil tillage application. It is due to deceleration of growth processes at the beginning of vegetation, because direct sowing did not facilitated optimization of growth processes and development of soy root system. Intensive growth of plant leaves continued till blooming phase. LI decreased under traditional tillage and somehow increased under direct sowing application from blooming phase to beans growing LI. With traditional soil tillage application, leaves area reduction was due to outflow of plastic substances from vegetative plant parts in the bottom area to generative that facilitated leaves extinction. As it was stated, growth processes decelerated under direct sowing, therefore growth and development phase decelerated as well. LI increased during the vegetation period.

In the variant with direct sowing and application of $N_{60}P_{60}K_{60}$, best conditions for leaves formation were created. In the phase of beans growing, LI was 2.83. With application of traditional sowing method, maximum level of LI was in the blooming phase - 7.77.

Lower level of LI under direct sowing influenced accumulation of dry matter during the vegetation. In the growing phase accumulation of dry matter was lower for 0.40-0.67 t/ha, compared to traditional tillage.

It was found that nitrogen fertilizers with application of phosphorus-potassium fertilizers highly influenced on dry matter accumulation despite of soil tillage methods. This parameter up to the beans formation phase in the $N_{60}P_{60}K_{60}$ variant with direct sowing was 3.56, with tillage – 9.07, that was for 1.61 and 3.99 t/ha more than in control variant.

Despite of tillage method, dose of $N_{80}P_{60}K_{60}$ did not effected much on dry matter accumulation. This means that to create optimal conditions for plant growth and development, soy does not need high fertilizers doses.

General tendencies for dry matter accumulation and growth of leaves area in plants was confirmed by indicator of photosynthesis productivity (IPP). During all vegetation periods IPP depended on soil tillage method and fertilizers application dose. In a nodding phase with tillage application this parameter highly increased, compared to direct sowing (Pic.1). This is due to creation of better conditions for germination of soy seeds by traditional tillage. In next periods IPP was higher than in no tillage variants.

With application of $N_{60}P_{60}K_{60}$ photosynthesis productivity was on the maximum level. In the blooming phase with nitrogen fertilizers application and phosphorus-potassium background, level of IPP was 7.37-9.22 g/m² per day, which was for 0.18-2.03 higher than in control variant. In the next phases of growth and development, soy IPP decreased. IPP was the highest with direct sowing. We think it is due to facilitation of favorable conditions for photosynthesis by tillage only at the beginning of vegetative period. Though up to the blooming phase, narrow sowing method fields of soy formed big leaves areas and created a shade for bottom and middle levels by leaves at the top. This caused decrease of IPP.

Lower level of leaves index and accumulation of dry matter under direct sowing determined decrease of soy yield. Soy yield in a variant with $N_{40}P_{60}K_{60}$, yield was 3.08 t/ha that was for 0.73 t/ha higher than in the control variant. The highest yield was in the variants $N_{40}P_{60}K_{60}$ and $N_{60}P_{60}K_{60}$ – 3.21 t/ha. With application of $N_{80}P_{60}K_{60}$ yielded decreased to 3.04 t/ha.

Conclusions Plants straggled in growth in the variants with direct sowing application that determined decrease of leave index and accumulation of dry matter. Though in the period from blooming to beans formation, level of photosynthesis productivity was higher. When applying direct sowing, nitrogen application on background of $P_{60}K_{60}$, it facilitated activization of plant growth. Though yield of soy in transition period to non-tillage system was lower, compared to other tillage methods.

List of references

1. Афендулов К. П. Влияние сроков внесения, сочетания и доз удобрений на фотосинтетическую активность растений / К. П. Афендулов // Вестник с.-х. науки. – 1969. – № 5. – С. 53–56.
2. Белоусова Л. П. Нарастание площади листьев у трех гибридов кукурузы / Л. П. Белоусова // Растениеводство. – 1968. – № 5. – С. 52–55.
3. Генгель П. А. Физиология растений / П. А. Генгель. – М.: Просвещение, 1974. – 191 с.
4. Ничипорович А. А. О фотосинтезе растений / А. А. Ничипорович. – М.: Правда, 1948. – 31 с.
5. Колісник С. І. Формування продуктивності сої залежно від способів сівби, густоти рослин і добрив в умовах центрального Лісостепу України: автореф. дис. на здобуття наук. ступ. канд. с.-г. наук: С. І. Колісник. - К., – 1996. – 18 с.
6. Бабич А. О. Сорти сої і перспективи виробництва її в Україні / А. О. Бабич // Пропозиція. – 2007. – № 4. – С. 46 – 49.
7. Агрохімічний аналіз: підручник / [М. М. Городній, В. П. Каленський, А. В. Бикін та ін.]. – К: Арістей, 2007. – 487 с.
8. Петриченко В. Ф., Материнський П. В. Фотосинтетична діяльність і продуктивність кормових бобів залежно від факторів інтенсифікації в умовах Лісостепу України / В. Ф. Петриченко, П. В. Материнський // Корми і кормовиробництво. – 2002. – Вип. 48. – С. 143 –147.