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# SOYBEAN YIELD UNDER DIFFERENT TILLAGE SYSTEMS

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**Abstract.** In Poland the soybean is becoming an increasingly more popular crop plant that is valued, among others, for the high nutritional value of its seeds. There are few studies on the effect of tillage systems used for soybean which are carried out in the climatic conditions of our country. This proves the need to continue such research. The present study investigated the effect of plough tillage and direct seeding on seed yield and some yield components of two soybean cultivars (Augusta and Aldana) in the climatic conditions of central-eastern Poland. A three-year field experiment was established on lessive soil using a split-block design in four replications. The study showed that cv. Aldana produced higher seed yield by 10.6% compared to the other cultivar; this cultivar was also characterized by higher plant density after emergence and before harvest, a higher number of seeds per pod, and higher 1000 seed weight. Seed yield significantly varied depending on the tillage system used. Under conventional tillage, soybean produced 14.7% higher yield than in the case of direct seeding. Compared to plough tillage, no-tillage significantly reduced plant height and first pod height as well as plant density after emergence and before harvest.

**Key words**: *Glycine max* L., cultivar, plough tillage, direct seeding, seed yield, yield components

## INTRODUCTION

The soybean is a leguminous plant of particularly high commercial values. Its seeds, contains about 40% of protein and 20% of oil, are used for direct consumption as well as for the production of processed foodstuffs, including infant formulas and edible oil. Among others, the breeding of cultivars adapted to our climatic conditions as well as the higher nutritional value and lower lodging requirements of soybean, compared to other leguminous plants, make an argument for the popularisation of soybean cultivation in Poland.

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In recent years, interest has increased in conservation tillage in Poland; this tillage system consists in leaving organic matter on the soil surface or near it and in reducing soil tillage intensity [Ball et al. 1994, Lopez-Fando and Almendros 1995, Kęsik et al. 2007]. In addition to a significant reduction in production costs, conservation tillage contributes to very beneficial changes in the soil environment [Höppner et al. 1995, Reeves 1997, Rajewski et al. 2012]. One of the options of conservation tillage is direct drilling or sowing which is based on a concept that no tillage is done since the harvest of the previous crop until the sowing of the succeeding crop. Straw of the previous crop remains on the field surface and before sowing is done it is usually necessary to use a non-selective herbicide. Low labour intensity of this system creates, among others, the possibility of growing crops in locations where it is a problem to maintain the optimal sowing time. Direct sowing in mulch also positively affects the soil structure [Kęsik and Błażewicz-Woźniak 2010] and water content not only in the topsoil but also at greater depths [Majchrzak et al. 2004, Shulan et al. 2009].

There are few studies on the effect of direct drilling on yield of soybean cultivars grown in Poland [Bujak et al. 2001, Bujak et al. 2004]. This confirms the need to further continue such research.

The aim of the present study was to compare the effect of plough tillage and direct seeding on yield of two soybean cultivars in the conditions of the Lublin Upland.

## MATERIALS AND METHODS

A field experiment was carried out in the years 2009–2012 at the Czesławice (51°18'23"N, 22°16'2"E) Experimental Farm belonging to the University of Life Sciences in Lublin. In 2010 the soybean plantation was terminated due to adverse atmospheric conditions and the resultant retarded emergence.

The experiment was established on lessive soil using a split-block design in four replications. The soil showed an slightly acidic ph (pH w 1 mol KCl = 6,2). It was characterized by high availability of phosphorus and potassium as well as average magnesium availability. The humus content was at a level of 1.2%. The sown area of the plots was 24 $m^2$, while the harvested area was 15 $m^2$. The experimental factors were as follows:

I. Soybean cultivars:

A. Augusta

B. Aldana

II. Tillage systems:

a. Plough tillage – skimming, double harrowing, autumn ploughing (to a depth of 25 cm). Spring: harrowing, cultivating, harrowing, sowing.

b. Direct seeding – without mechanical tillage. In the spring, only Roundap Energy 450 SL (active ingredient (a.i.) – glyphosate) was applied at a rate of 3 $l \cdot ha^{-1}$.

Mineral fertilization was applied in whole before sowing at the following amount: N – 50 $kg \cdot ha^{-1}$, P – 35 $kg \cdot ha^{-1}$, K – 83 $kg \cdot ha^{-1}$. Fertilizer rates were determined on the basis of nutritional requirements of the crop plant and soil nutrient availability.

Each year, soybean was sown at the turn of April and May in a field after winter wheat. The row spacing was 20 cm, sowing depth 3 cm, and planned plant density 100 plants per 1m$^2$.

Before sowing, soybean seeds were inoculated with *Bradyrhizobium japonicum* bacteria and the seed dressing Vitavax 200 FS (a.i. carboxin, thiram) was applied at a rate of 400 ml/100 kg of seed with water added at a 1:1 ratio. Immediately after sowing, a mixture of the herbicides Afalon Dispersive 450 SC (a.i. linuron) and Dual Gold 960 EC (a.i. S-metolachlor) was applied at an amount of 1 l + 1.8 l·ha$^{-1}$.

Each year, soybean was harvested in the first decade of September. The results obtained in the years 2009, 2011, and 2012 were statistically analysed by analysis of variance, while the significance of differences was evaluated by Tukey's test at the $\alpha = 0.05$ level of significance. Plant density after emergence and before harvest was estimated in two rows along a length of 2.5 m. The yield traits were determined based on a sample consisting of 30 randomly selected plants from each plot. Seed yield was weighed separately for each plot and the obtained results were expressed on a per hectare basis.

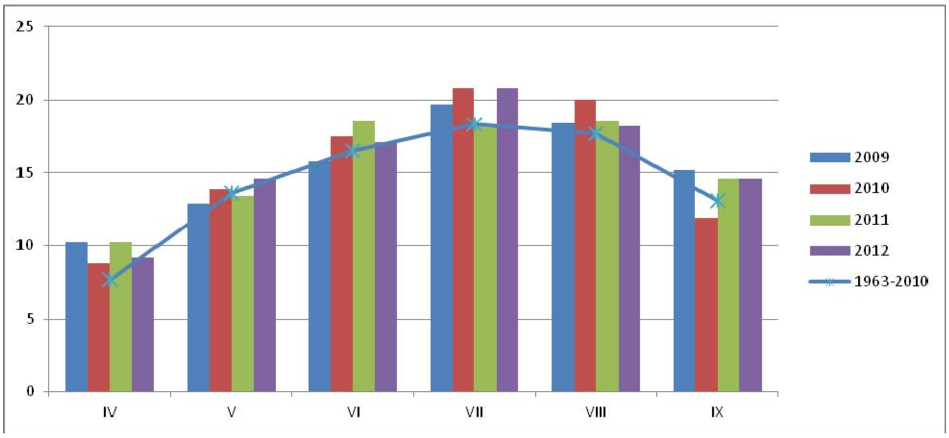


Fig. 1. Mean monthly air temperature (°C) at the Czesławice Meteorological Station in 2009–2012

In the first year of the study (2009), the mean air temperature in particular months of the growing season was generally higher than the long-term mean (fig. 1). These values were lower only in May and June. Precipitation in 2009 exceeded the long-term average also only in May and June (fig. 2). The next growing season (2010) proved to be unfavourable for soybean, primarily due to a rather low temperature in the sowing month (IV) and heavy rainfall in May which much exceeded the long-term average. On account of unsatisfactory emergence, the soybean plantation was terminated in the second year of the experiment. The year 2011 turned out to be favourable for soybean development in terms of thermal conditions. In particular months of the growing season, higher or similar (May, July) temperatures were generally recorded compared to the long-term mean. Lower than average rainfall was recorded in the initial period of soy-

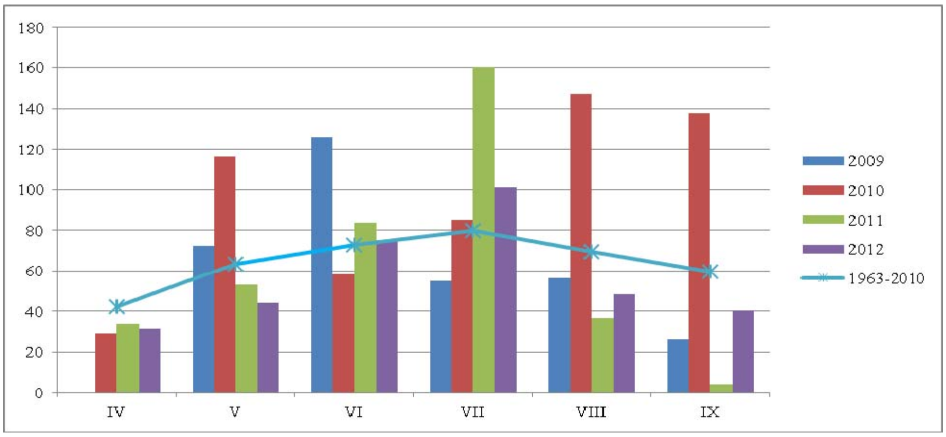


Fig. 2. Total rainfall and rainfall distribution (mm) at the Czesławice Meteorological Station in 2009–2012

bean growth (April and May) as well as during maturation and harvest (August, September). The last year of the study (2012) was very warm and quite dry. Higher than average temperature was recorded in all months. Total rainfall exceeded the long-term mean in June and July.

## RESULTS

Soybean seed yield was significantly modified by the experimental factors used (tab. 1). On average for the three-year study period, the cultivar Aldana produced higher yield by 10.6%. As regards the individual years of the experiment, higher seed yield of the soybean cultivar Aldana, compared to Augusta, was proved only in 2011. Irrespective of the cultivar and experimental year, significantly higher seed yield (by 14.7%) was obtained when plough cultivation was used, compared to that found in the direct seeding treatment. An increase in soybean yield in the conventional tillage treatment was proved in the first year of the study.

Table 1. Soybean seed yield ($t \cdot ha^{-1}$)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 3.01 | 1.95 | 2.48 | 2.71 | 2.05 | 2.38 | 2.86 | 2.00 |
| 2011 | 1.91 | 2.10 | 2.00 | 3.30 | 3.05 | 3.18 | 2.60 | 2.58 |
| 2012 | 2.73 | 2.45 | 2.59 | 2.27 | 2.28 | 2.28 | 2.50 | 2.36 |
| Mean | 2.55 | 2.17 | 2.36 | 2.76 | 2.46 | 2.61 | 2.65 | 2.31 |
| $LSD_{0.05}$ | cultivar – 0.189, tillage system – 0.189, cultivar × tillage system – n.s., cultivar × year – 0.484, tillage system × year – 0.484, cultivar × tillage system × year – n.s. | | | | | | | |

The tillage systems had a significant effect on soybean plant height (tab. 2). Plough tillage had more beneficial effect compared to no-tillage (by 10.5%). Plant height did not differ significantly depending on the cultivar. However, in the case of Aldana the differences in the value of the trait in question were proved between years. In 2011 plants of this cultivar were significantly higher by 27.7% and 50.2% compared to the years 2009 and 2012.

Table 2. Soybean plant height (cm)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 82.4 | 73.3 | 77.8 | 76.0 | 63.1 | 69.6 | 79.2 | 68.2 |
| 2011 | 72.2 | 65.8 | 69.0 | 91.3 | 86.5 | 88.9 | 81.8 | 76.2 |
| 2012 | 71.6 | 67.2 | 69.4 | 62.0 | 56.4 | 59.2 | 66.8 | 61.8 |
| Mean | 75.4 | 68.8 | 72.1 | 76.4 | 68.7 | 72.6 | 75.9 | 68.7 |
| $LSD_{0.05}$ | cultivar – n.s., tillage system – 3.57, cultivar × tillage system – n.s., cultivar × year – 9.16, tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

On average for the three-year study period, first pod height was significantly higher (by 1.7 cm) under conventional plough tillage compared to the no-tillage treatment (tab. 3). Significant differences were also found in 2009 when the first pods were set 4.8 cm higher in the ploughed plots compared to the direct seeding treatment. Proven differences in the value of the trait in question, depending on the cultivar, were only found between years. First pod height in cv. Aldana was significantly higher in 2011 compared to that found in the last year of the experiment.

Table 3. First pod height (cm)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 11.9 | 7.4 | 9.6 | 10.8 | 5.9 | 8.4 | 11.4 | 6.6 |
| 2011 | 8.4 | 9.4 | 8.9 | 10.9 | 11.3 | 11.1 | 9.6 | 10.4 |
| 2012 | 8.7 | 9.0 | 8.8 | 9.3 | 6.7 | 8.0 | 9.0 | 7.8 |
| Mean | 9.7 | 8.6 | 9.1 | 10.3 | 8.0 | 9.2 | 10.0 | 8.3 |
| $LSD_{0.05}$ | cultivar – n.s., tillage system – 1.14, cultivar × tillage system – n.s., cultivar × year – 2.91, tillage system × year – 2.91, cultivar × tillage system × year – n.s. | | | | | | | |

The experimental factors significantly modified plant density after emergence and before harvest (tabs 4 and 5). The cultivar Aldana was characterized by higher plant density, compared to Augusta, by respectively 40.1% after emergence and 46.8% before harvest. Higher plants density in cv. Aldana, compared to Augusta, was also proved in

2011. Under conventional tillage, plants density was higher by 39.5% after emergence and 31.7% before harvest compared to that obtained under direct seeding. In the ploughed plots, significantly higher plants density was also recorded after emergence in 2009 and 2012 as well as before harvest in 2009.

Table 4. Plant density after emergence (plants·m$^{-2}$)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 71.0 | 38.2 | 54.6 | 58.5 | 36.5 | 47.5 | 64.8 | 37.4 |
| 2011 | 16.2 | 22.0 | 19.1 | 83.5 | 75.8 | 79.6 | 49.8 | 48.9 |
| 2012 | 56.8 | 38.0 | 47.4 | 53.0 | 32.5 | 42.8 | 54.9 | 35.2 |
| Mean | 48.0 | 32.7 | 40.4 | 65.0 | 48.3 | 56.6 | 56.5 | 40.5 |
| $LSD_{0.05}$ | cultivar – 5.45, tillage system – 5.45, cultivar × tillage system – n.s., cultivar × year – 13.95, tillage system × year – 13.95, cultivar × tillage system × year – n.s. | | | | | | | |

Table 5. Plant density before harvest (plants·m$^{-2}$)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 62.2 | 32.8 | 47.5 | 50.0 | 33.8 | 41.9 | 56.1 | 33.3 |
| 2011 | 15.5 | 21.0 | 18.2 | 79.8 | 73.0 | 76.4 | 47.6 | 47.0 |
| 2012 | 47.2 | 34.5 | 40.8 | 44.2 | 31.8 | 38.0 | 45.7 | 33.2 |
| Mean | 41.6 | 29.4 | 35.5 | 58.0 | 46.2 | 52.1 | 49.8 | 37.8 |
| $LSD_{0.05}$ | cultivar – 5.20, tillage system – 5.20, cultivar × tillage system – n.s., cultivar × year – 13.31, tillage system × year – 13.31, cultivar × tillage system × year – n.s. | | | | | | | |

The number of pods per plant was significantly dependent on the soybean cultivar (tab. 6). On average for three-year study period, 61.5% more pods were found in cv. Augusta than in Aldana. The study also proved a higher value of the trait in question for cv. Augusta in 2011. The tillage system was not found to have a significant effect on the number of pods per plant.

On average for the study period, a 17.6% higher number of seeds per pod was proved in cv. Aldana compared to that determined for cv. Augusta (tab. 7).

The number of seeds per plant differed significantly depending on the soybean cultivar (tab. 8). The value of this trait was higher in cv. Augusta (by 34.9%). A higher number of seeds per plant in Augusta cv. compared to Aldana cv. was also proved in 2011.

The experimental factors did not modify significantly seed weight per plant (tab. 9). It differed significantly only depending on the cultivar and year. In 2011 higher seed weight per plant by 65.3% was found in cv. Augusta compared to that determined for Aldana.

Table 6. Number of pods per plant (pcs.)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 20.7 | 26.6 | 23.6 | 23.4 | 25.1 | 24.2 | 22.0 | 25.8 |
| 2011 | 51.8 | 45.7 | 48.8 | 19.5 | 16.0 | 17.8 | 35.6 | 30.8 |
| 2012 | 30.7 | 31.0 | 30.8 | 17.4 | 26.5 | 22.0 | 24.0 | 28.8 |
| Mean | 34.4 | 34.4 | 34.4 | 20.1 | 22.5 | 21.3 | 27.2 | 28.5 |
| $LSD_{0.05}$ | cultivar – 3.46, tillage system – n.s., cultivar × tillage system – n.s., cultivar × year – 8.86, tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

Table 7. Number of seeds per pod (pcs.)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 1.6 | 1.8 | 1.7 | 1.8 | 1.8 | 1.8 | 1.7 | 1.8 |
| 2011 | 1.8 | 1.4 | 1.6 | 1.8 | 2.8 | 2.3 | 1.8 | 2.1 |
| 2012 | 1.8 | 1.8 | 1.8 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 |
| Mean | 1.7 | 1.7 | 1.7 | 1.9 | 2.2 | 2.0 | 1.8 | 1.9 |
| $LSD_{0.05}$ | cultivar – 0.30, tillage system – n.s., cultivar × tillage system – n.s., cultivar × year – n.s., tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

Table 8. Number of seeds per plant (pcs.)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 34.1 | 46.8 | 40.4 | 42.5 | 46.3 | 44.4 | 38.3 | 46.6 |
| 2011 | 92.0 | 65.6 | 78.8 | 36.2 | 45.0 | 40.6 | 64.1 | 55.3 |
| 2012 | 56.5 | 55.4 | 56.0 | 36.9 | 52.9 | 44.9 | 46.7 | 54.2 |
| Mean | 60.9 | 55.9 | 58.4 | 38.5 | 48.1 | 43.3 | 49.7 | 52.0 |
| $LSD_{0.05}$ | cultivar – 9.43, tillage system – n.s., cultivar × tillage system – n.s., cultivar × year – 24.15, tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

Table 9. Seed weight per plant (g)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 4.9 | 6.6 | 5.8 | 6.9 | 7.0 | 7.0 | 5.9 | 6.8 |
| 2011 | 14.7 | 10.1 | 12.4 | 7.0 | 8.0 | 7.5 | 10.8 | 9.0 |
| 2012 | 6.6 | 6.9 | 6.8 | 5.1 | 7.5 | 6.3 | 5.8 | 7.2 |
| Mean | 8.7 | 7.9 | 8.3 | 6.3 | 7.5 | 6.9 | 7.5 | 7.7 |
| $LSD_{0.05}$ | cultivar – n.s., tillage system – n.s., cultivar × tillage system – n.s., cultivar × year – 3.84, tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

Table 10. 1000 seed weight (g)

| Year | Augusta | | | Aldana | | | Mean | |
|---|---|---|---|---|---|---|---|---|
| | plough tillage | direct seeding | mean | plough tillage | direct seeding | mean | plough tillage | direct seeding |
| 2009 | 141.9 | 140.4 | 141.2 | 160.1 | 155.5 | 157.8 | 151.0 | 148.0 |
| 2011 | 159.9 | 156.5 | 158.2 | 193.7 | 185.2 | 189.4 | 176.8 | 170.8 |
| 2012 | 114.3 | 120.9 | 117.6 | 135.0 | 138.2 | 136.6 | 124.6 | 129.6 |
| Mean | 138.7 | 139.3 | 139.0 | 162.9 | 159.6 | 161.3 | 150.8 | 149.5 |
| $LSD_{0.05}$ | cultivar – 5.50, tillage system – n.s., cultivar × tillage system – n.s., cultivar × year – n.s., tillage system × year – n.s., cultivar × tillage system × year – n.s. | | | | | | | |

Thousand seed weight was significantly dependent on the soybean cultivar (tab. 10). The difference in favour of Aldana cv. was 22.3 g (16.0%) on average for the three-year study period.

## DISCUSSION

As regards the two soybean cultivars grown in the experiment, higher seed yield was obtained in the case of Aldana. Lorenc-Kozik et al. [1998] obtained different results in their study; in comparing soybean seed yields, they found better results for the small-seeded cultivar Nawiko in relation to the large-seeded cultivar Aldana. On the other hand, Pisulewska et al. [1998] obtained similar seed yields in the case of the cultivars Aldana and Nawiko, but they were higher than those determined for the cultivars Progres and Polan. According to these authors, Aldana proved to be the most stable in yielding ability in particular years.

In the present experiment, the higher yielding cultivar Aldana showed higher values for the following traits: plants density after emergence and before harvest. However, plants density was much lower than expected (100 plants per 1 $m^2$) in each year of the study. Various factors can inhibit seed germination in legumes. According to Prusiński [1997], this can be, among others, imbibitional chilling stress to which quickly swelling seeds are exposed in the soil with too low temperature. This stress leads to the destruction of the tissues of the cotyledons, hypocotyl, and radicle tip. Strongly compacted soil may also have an effect on this [Munkholm et al. 2003].

In the experiment in question, significantly higher seed yield of soybean was obtained under conventional plough tillage. Likewise, Pikul et al. [2001] found that under the conditions of limited autumn tillage (strip tillage done only for future soybean rows) and direct seeding in spring there can be a significant (17%) reduction in seed yield in dryer years. Using direct seeding in their research, Javurek and Vach [1999], Bujak et al. [2001, 2004] as well as Amini [2005] recorded a significant decrease in yield (up to 24%) compared to conventional tillage. On the other hand, Lund et al. [1993] did not find a reduction in seed yield of soybean grown in rotation using direct seeding, but there was a decrease in yield when soybean was grown in monoculture. The study of Gawęda and Szymankiewicz [2007] proved that the soybean cultivar Aldana grown in rotation responded by a significant reduction in yield (16%) when plough tillage had been abandoned. Korzeniowska and Stanisławska-Glubiak [2009] also report a decrease in yields of legumes (faba bean and field pea) as a result of replacement of conventional tillage by direct seeding.

A decrease in crop yield under direct seeding can be associated, among others, with the effect of specific physico-chemical soil properties which are not always favourable. According to Pabin [2002], under direct seeding conditions only the upper part of the soil humus layer accumulates a larger amount of organic substances and some fertilizer nutrients (phosphorus and potassium); topsoil acidification, the proportion of large diameter pores (above 30 mm), and water infiltration also increase. Carter [2005] indicates that under direct seeding conditions, compared to plough tillage, the organic carbon content in the soil under soybean and barley is higher only in the 0–10 cm layer, whereas the organic nitrogen content is lower in the entire investigated layer (0–60 cm). According to Botta et al. [2007], the reduction in soybean seed yield can be attributable to increasing soil acidification under direct sowing conditions. The results included in this paper show a lower density of soybean plants under direct seeding conditions compared to conventional plough tillage. Therefore, it can be presumed that the reason for this could have been the higher density of the topsoil which inhibited plant emergence and, in effect, resulted in lower yield of both soybean cultivars. Lower plants density, which had an effect on reducing yield under direct sowing conditions, was also observed by Ciesielska and Rzeźnicki [2007] in their study. These authors noted that, compared to plough tillage, under no-tillage conditions the plants density was particularly unfavourable in the first year of cropping using this technique. A similar relationship was also observed in the study presented in this paper. In the opinion of Campbell et al. [1993], lower yields obtained under no-tillage cultivation, compared to conventional tillage, can also result from lower nitrogen availability to plants caused by slower mineralisation of nitrogen and its higher immobilisation under direct sowing conditions.

According to Arshad [1999] and De Vita et al. [2007], benefits arising from the use of direct sowing can be observed in warm years with lower rainfall. In the experiment, did not find such a relationship, despite that all the years when soybean was grown were characterized by lower rainfall and higher temperature relative to the long-term averages.

Even if lower yields are generally obtained when no-tillage is used, this does not necessarily mean lower profitability and does not need to make an argument for abandoning this tillage system. In the opinion of Dzienia et al. [2006], lower energy inputs on direct seeding can compensate the loss resulting from lower crop yields.

## CONCLUSIONS

1. Among the soybean cultivars compared, Aldana produced higher yield of seed and also showed higher values for most of the canopy and yield components.

2. The used tillage systems significantly modified the yielding ability of soybean. Under direct seeding, 12.8% lower seed yield was obtained in relation to conventional plough tillage.

3. Compared to plough tillage, no-tillage significantly reduced plant height and first pod height as well as plants density after emergence and before harvest.

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## PLONOWANIE SOI W RÓŻNYCH SYSTEMACH UPRAWY ROLI

**Streszczenie.** Soja staje się coraz bardziej popularną rośliną uprawną w Polsce, cenioną między innymi za dużą wartość odżywczą nasion. Badania dotyczące wpływu sposobu uprawy roli pod soję prowadzone w warunkach klimatycznych naszego kraju są nieliczne. Świadczy to o potrzebie dalszej ich kontynuacji. W niniejszej pracy badano wpływ systemów uprawy roli: płużnego i siewu bezpośredniego na plon nasion oraz wybrane elementy plonowania dwóch odmian soi (Augusta i Aldana), w warunkach klimatycznych południowo-wschodniej Polski. Trzyletni eksperyment polowy założono na glebie płowej wytworzonej z lessu, metodą split-block w czterech powtórzeniach. Wykazano, iż z porównywanych odmian o 10,6% lepiej plonowała Aldana, która charakteryzowała się również większą obsadą roślin po wschodach i przed zbiorem, liczbą nasion w strąku oraz masą 1000 nasion. Plon nasion był istotnie zróżnicowany w zależności od zastosowanego systemu uprawy roli. W warunkach uprawy płużnej soja plonowała o 14,7% lepiej niż w siewie bezpośrednim. W porównaniu z systemem płużnym uprawa zerowa znacząco obniżyła wysokość roślin, wysokość zawieszenia pierwszego strąka oraz obsadę po wschodach i przed zbiorem soi.

**Słowa kluczowe**: *Glycine max* L., odmiana, płużny system uprawy roli, siew bezpośredni, plon nasion, elementy plonowania

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