

## EFFECT OF METEOROLOGICAL CONDITIONS ON THE PRODUCTION OF NS SOYA BEAN SEED

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**Summary.** The perspective of our society cannot be imagined without the quality production and marketing of seeds in the country and abroad. On average, seed soya bean was annually planted on area of 7,151.8 ha in the period 2002-2007. Area under NS soya bean seed showed an annual trend rate of growth (9.21% with certain oscillations). In the research period, soya bean seed yield was 2.29 t ha<sup>-1</sup> with a highly stable growth rate of 2.66%, while NS soya bean seed production in Serbia was 15,993 t with an annual growth rate of 12.59% with certain oscillations. Permanent growing trend of soya bean production is a result of increased area and yield. The increase of production was also affected by weather conditions. Such production volume fully meets domestic needs, while significant amount of seed still remains for export.

**Key words:** soya bean, seed, NS cultivars, meteorological conditions, production parameters

### Introduction

Soya bean (*Glycine max (L.) Merr.*) is one of the most important industrial plants in Serbia. Owing to its favourable agroecological conditions, Vojvodina Province is the major soya bean growing region of Serbia. The importance of this crop is primarily due to its chemical grain composition – circa 40% protein and 20% oil, amounting to more than 60% of nutrients (Hrustić et al., 2009).

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Soya bean production has a permanent growth trend, both in the world and in the Republic of Serbia. In the period 2002-2007 soya bean was planted on area of 89.66 million ha worldwide (FAO, 2009). Soya bean planted area had an annual growth rate of 3.79%. Worldwide average soya bean yield of 2.29 t ha<sup>-1</sup> (FAO, 2009) is on a standstill. In the same period worldwide soya bean production was 205.33 million tons (FAO, 2009) with an annual growth rate of 3.95%.

Average soya bean planted area in the Republic of Serbia in the same period was 127,330 ha. The largest area (157,000 ha) was planted in 2006 (FAO, 2009). Soya bean planted area showed an annual trend rate of growth (6.80%). Average soya bean yield in Serbia in the same period was 2.41 t/ha (FAO, 2009). Yield in Serbia was by 0.120 t higher than the world average with an annual growth rate of 2.50%. Average soya bean production in Serbia for the period 2002-2007 was 314,830 tons (FAO, 2009) with an annual growth rate of 9.47%.

Among many competitive brand products from all around the world, there arises an interest of the producers and processors to market quality products, especially those of "higher quality" (Kotler, 2003). The production of quality seed, control and sales of cultivar seed are based on legislation and science (Milošević and Malešević, 2004).

The perspectives of Soya bean Department of Institute of Field and Vegetable Crops, Novi Sad lay in a successfully planned NS soybean seed production, based on contemporary cultivation practices, high cultivar yield potential equal to that of cultivars from other countries much more developed in agriculture, science and economy, as well as export.

The aim of this research was to analyze NS soya bean seed production. One of important prerequisites for successful soya bean production is the use of quality seed and cultivars adequate for the growing region. Having this in mind, Institute of Field and Vegetable Crops aims at increased soya bean seed quality and other product performances.

### **Materials and Methods**

Seed production parameters of NS soya bean cultivars in Serbia were analysed in this paper for the period 2002-2007. The research was based on available data from statistical publications, original data from Institute of Field and Vegetable Crops, Novi Sad and FAO. Standard cultivar practices were used in soya bean seed production. Meteorological data used for evaluation of weather conditions for the research period were taken from meteorological station at Rimski Šančevi, Novi Sad.

Average precipitation for the period 2002-2007 was 381.92 mm, which is by 6,8 mm more than long-term average for the same location, while average temperatures were 18.62°C, which is by 0.62°C higher than long-term average according to data from meteorological station at Rimski Šančevi (Fig. 1 and 2).

The Institute's data on seed production of NS soya bean cultivars included the yield of processed seed, which was determined by latest methods used in seed production. The data were statistically processed as follows (Mihailović, 2008):

- the coefficient of variation method,  $C_V = \sigma \cdot 100 / \bar{X}$
- trends of parameters were calculated by the exponential trend equation,  $Yt = a b^{xi}$

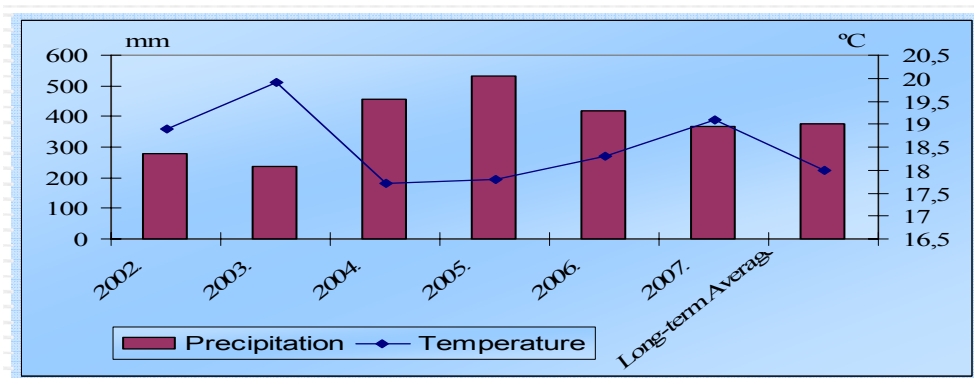


Fig. 1. Precipitation and temperatures at Rimski Šančevi, 2002-2007

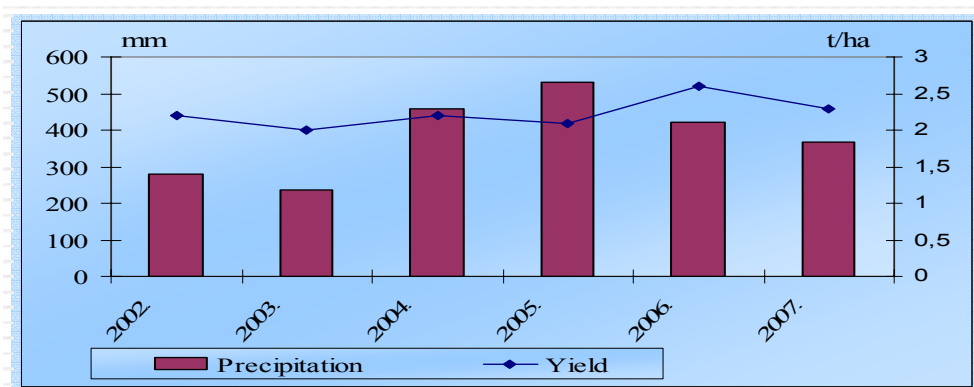


Fig. 2. Precipitation and seed yield of NS soya bean cultivars in Serbia, 2002-2007

The data were analyzed by the statistical and mathematical procedures mentioned above. The seed production and its trends are presented in tables and graphs.

### Results and Discussion

Average NS soya bean planted area in the Republic of Serbia in the research period (2002-2007) was 7,151.8 ha. This area showed an annual growth rate of 9.21% with higher oscillation (CV=21.86%) (Tab. 1, Fig. 3). Average seed yield of NS soya bean cultivars in the research period was 2.29 t ha<sup>-1</sup>. The yield showed an annual growth rate of 2.66 %. Stability of average seed yield of NS soya bean cultivars in the Republic of Serbia is evident, with some oscillations (CV=6.82 %) (Tab. 1, Fig. 3).

Seed yield of NS soya bean cultivars ranged from 2.0 t ha<sup>-1</sup> to 2.6 t ha<sup>-1</sup>. During six research years, annual variations in temperatures and precipitation quantity and distribution were profound. Such annual variations of weather conditions significantly affected soya bean growth and development, resulting in significantly different yields during the research period. Soya bean seed yield varied according to precipitation quantity and distribution.

Table 1. NS soya bean seed production parameters in Serbia, 2002-2007

Production parameters	Average values	Rate of change (%)	CV (%)
Acreage (ha)	7,151.8	9.21	21.86
Yield (t ha <sup>-1</sup> )	2.29	2.66	6.82
Production volume (t)	15,993	12.59	27.02

Source: Calculated on the basis of data recorded at Institute of Field and Vegetable Crops, 2009.

Quantities and distribution of precipitation in 2002 and 2003 was below long-term average, while in 2004, 2005 and 2006 there were significantly more favourable. Precipitation quantity in 2007 was relatively uniform with long-term average, as shown in figure 1.

The most favourable temperatures (18.3°C) and precipitation quantity (420 mm) and distribution were in 2006 when the highest seed yield of NS soya bean was gained (2.6 t ha<sup>-1</sup>). Temperature was higher than long-term average by 0.30°C, and precipitation by 45 mm.

Within the research period, the most unfavourable year for soya bean production was 2003 which saw yield of  $2.0 \text{ t ha}^{-1}$ . Precipitation in the 2003 growing period was only 237 mm, which is by 138.1 mm lower than long-term average with unfavourable distribution (four months saw less than 30 mm). Temperature was  $19.9^\circ\text{C}$ , which is by  $1.9^\circ\text{C}$  higher than long-term average, as shown in figure 2. Extreme drought was aided by unusually high temperatures (tropical heat). There were 14 days with maximum temperature over  $30^\circ\text{C}$  in June, 12 in July and 26 in August, so that moisture deficiency was very unfavourable for plant growth and development and high yields.

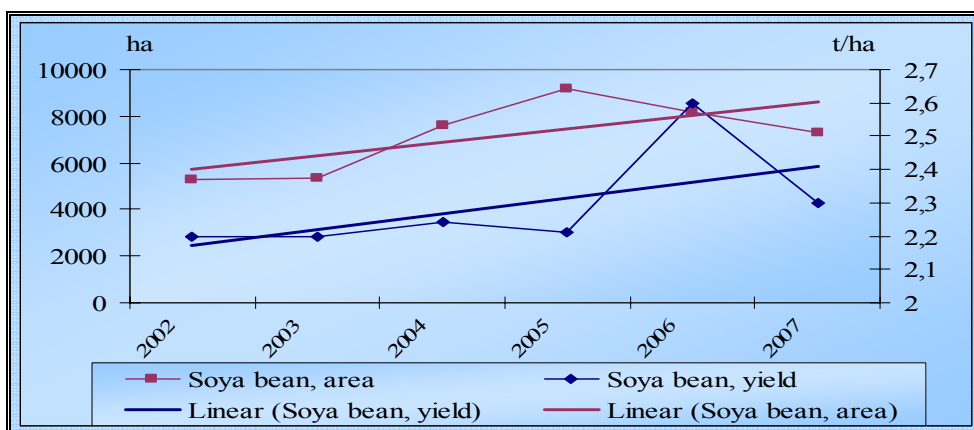


Fig. 3. Area (ha) and seed yield (t/ha) NS soya bean cultivars, 2002-2007

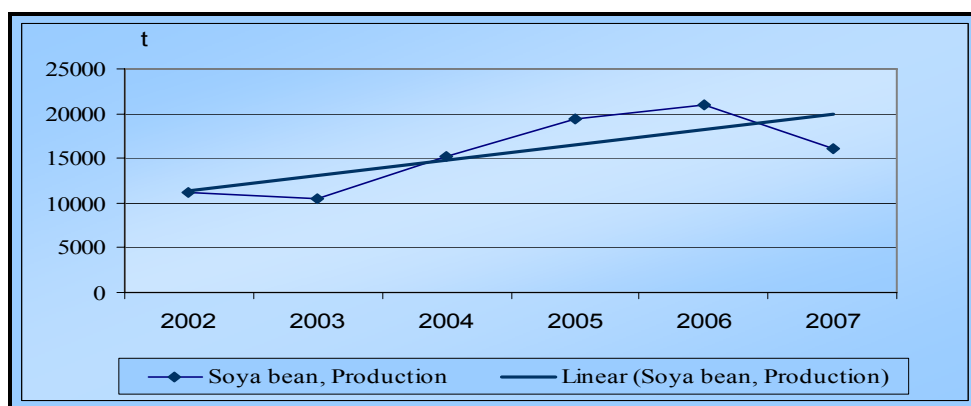


Fig. 4. Production of NS soya bean seeds (t), 2002-2007

Many studies show that increased soya bean yields are a result of adequate and timely application of cultivation practices (Al-Ithawi et al., 1980; Afza, 1987; Wood et al., 1993, Vidić et al. 2008, Đukić et al. 2009) which correct adverse meteorological conditions.

Seed production of NS soya bean cultivars showed a permanent growth trend. Increased seed production of NS soya bean cultivars resulted from permanent increase of area and yield. Average seed production of NS soya bean cultivars was 15,993 t in the research period and showed an annual growth rate of 12.59% (Tab. 1, Fig. 4 and 5).

Aside from weather conditions, introduction of new more-yielding cultivars also affected the increased production. NS soya bean cultivars (2002-2008) are: i) Valjevka, Galina, Afrodit, Proteinka, Bečejka and Alisa (0 maturity group), ii) Balkan, Ravnica, Novosađanka, Ana, Sava, Tea and Diva (I maturity group), iii) Vojvođanka, Venera and Mima (II maturity group). Very early cultivars Krajina, Jelica, Fortuna, Julija, Meli, Merkur and Prima (00 maturity group) are planted as the second or stubble crop. Newer soya bean cultivars offered since 2009 are: Victoria and Iskra (I maturity group) and Trijumf (II maturity group) (Vidić et al. 2008, 2010, Popović et al. 2010a).

Domestic cultivars dominate (99%) soya bean production in the Republic of Serbia. Institute of Field and Vegetable Crops has developed 92 cultivars in total, 38 of those have been released abroad, 34 of which have been released after 2001 (Miladinović et al. 2008).

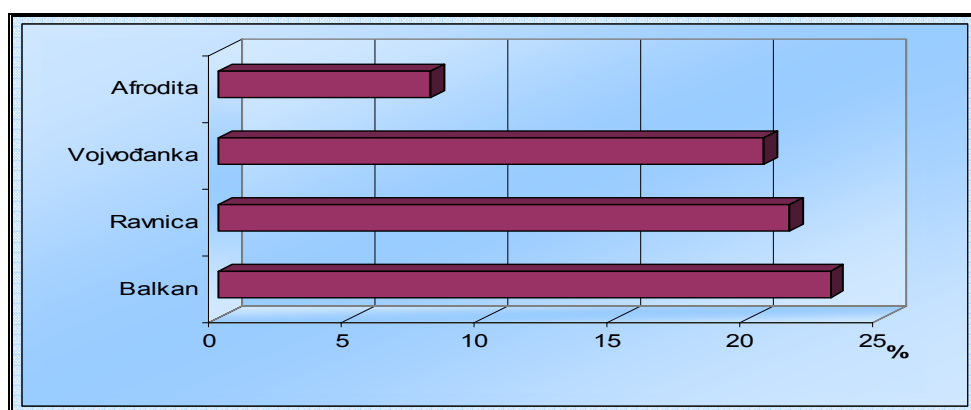


Fig. 5. The most popular NS soya bean cultivars (2002-2007) belonging to different maturity groups (0, I and II)

NS soya bean production increase is caused by technical and technological developments which facilitate increased production of NS soya bean seed in a time unit, as well as production of new quality cultivars. Seed quality of NS soya bean cultivars is the most important aspect which influences a positive image of the product in the minds of consumers (product image) and presents an important element of competitiveness.

Basic features of NS soya bean cultivars are high yield potential, good adaptability and yield stability, all of which enable these cultivars to be successfully grown in various weather conditions. It is extremely important to make an appropriate choice of NS soya bean cultivars, because it enables high and stable production, minimum investment and increased profit to producers (Popović, 2010).

### Conclusions

Based on a six-year analysis of NS soya bean seed production, there is a permanent growth trend of area, yield, production and sales of soya bean seed.

- In the period 2002-2007 NS soya bean seed was annually planted on 7,151.8 ha on average. Area showed an annual growth rate of 9.21%.
- NS soya bean seed yield in the same period reached 2.29 t ha<sup>-1</sup> with a growth trend rate of 2.66% and oscillation ranging from 2.0 (2003) to 2.6 (2006). This research showed that NS soya bean seed yield was affected by weather conditions. Soya bean yield varied according to quantities and distribution of precipitation in certain years. Maximum yield of 2.6 t ha<sup>-1</sup> was gained in 2006 when precipitation was higher than long-term average, whereas minimum yield of 2.0 t ha<sup>-1</sup> was gained in arid 2003.
- NS soya bean seed production in Serbia in the same period reached 15,993 tons with an annual growth rate of 12.59%. This volume of production fully meets domestic needs, while significant amount of seed still remains for export.

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## УТИЦАЈ МЕТЕОРОЛОШКИХ УСЛОВА НА ПРОИЗВОДЊУ СЕМЕНА НС СОРТИ СОЈЕ

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### Резиме

Перспектива нашег друштва се не може замислити без квалитетне производње и пласмана семена у земљи и иностранству. У периоду 2002-2007. под семенским усеvom соје засејано годишње је у просеку 7.151,8 ха. Површине под семеном НС сорти соје бележе тенденцију раста по стопи од 9,21 % годишње, са осцилацијама. Принос семена соје у посматраном периоду износио је 2,29 т/ха и бележи тенд раста по стопи од 2,66 % и велику стабилност. Производња семенске НС соје у Србији, у посматраном периоду, износи 15.993 т са тенденцијом раста по стопи од 12,59 % годишње и осцилацијама. Перманента тенденција раста производње соје резултанта је повећања површина и приноса. На раст производње деловали су и климатских фактори. Овакав обим производње у потпуности задовољава домаће потребе, а значајне количине семена остају и за извоз.

**Кључне рече:** соја, семе, НС сорте, метеоролошки услови, параметри производње

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