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## TILLAGE AND NITROGEN RATE EFFECTS ON SOYBEAN YIELD IN THE SPECIFIC CONDITIONS FROM DANUBE MEADOW

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**Abstract:** The aim of the performed research was to investigate the behaviour of the soybean crop at different tillage and nitrogen rates. In this respect, field experiments were performed under rainfed conditions located in South Romania, respectively in the Danube meadow, in the years 2023 and 2024. The experimental factors were: Factor A: Soil tillage (a1 - Ploughing - depth of 25 cm + 2 disc harrows – Control; a2 - Scarifying - depth of 35 cm + 2 disc harrows; a3 - Gruber Tiger - depth of 25 cm; a4 - Gruber Tiger - depth of 15 cm; a5 - Disc harrow - depth of 15 cm – 2 passed); Factor B; Nitrogen rate (b1 - N0 - unfertilized – Control; b2 - 60 kg/ha; b3 - 80 kg/ha; b4 - 120 kg/ha). The conventional tillage system had a positive response for 2023, given the high amount of precipitation in spring, but in the dry year 2024, the minimum tillage system played an important role in conserving water in the soil in spring, which led to better seed yields. Generally, in any tillage variant and climatic conditions, the increasing of the nitrogen rate was associated with a positive effect on the yield elements, seed yield and yield quality.

### • Introduction

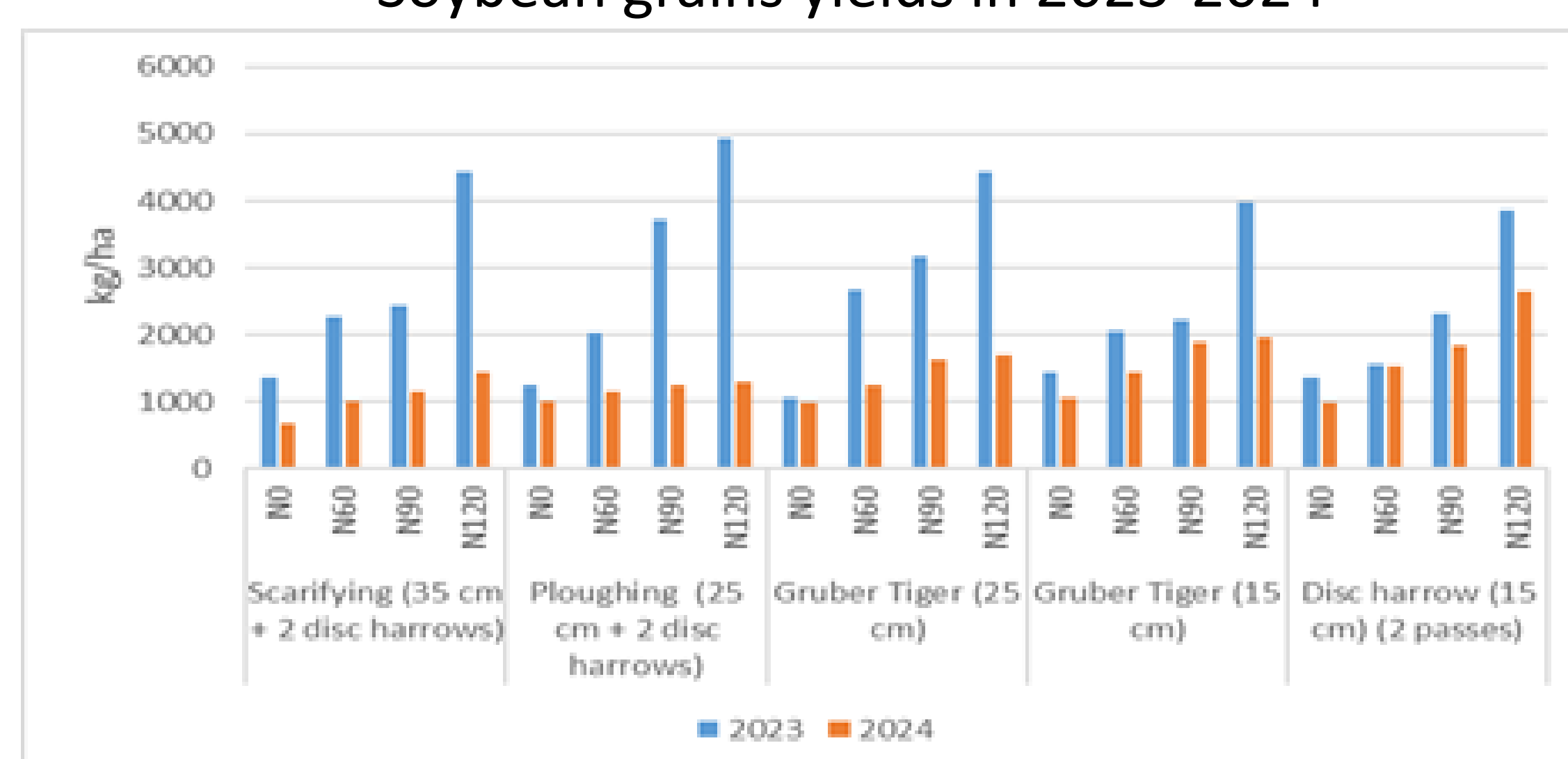
- Soybean is a plant with multiple uses. In Romania, in 2023, soybean was cultivated on 141,671 ha, with an average production of 2140 kg/ha, resulting in a total production of over 303 thousand tons (INS, 2024). Thanks to nitrogen fixing bacteria (*Bradyrhizobium japonicum*) on the roots, soybean can produce 50-150 kg nitrogen/ha, which ensures an increase in soil fertility (MAITY ET ALL., 2023).

### • Material and method

- The aim of the performed research was to investigate the behaviour of the soybean crop at different tillage and nitrogen rates conditions.
- The research was performed in field experiments under rainfed conditions within SC Agrochirnogi SA (one of the farms belonging to the company SC. Unic Prod Com SRL) located in South Romania, respectively in the Danube meadow, near Oltenița city from Călărași County.
- The field experiment was based on the method of subdivided plots into 3 replications, having two experimental factors (bifactorial experiment), respectively:
  - Factor A: Soil tillage, with 5 variants:
    - a1 - Ploughing - depth of 25 cm + 2 disc harrows (Control);
    - a2 - Scarifying - depth of 35 cm + 2 disc harrows;
    - a3 - Gruber Tiger - depth of 25 cm;
    - a4 - Gruber Tiger - depth of 15 cm;
    - a5 - Disc harrow - depth of 15 cm (2 passed).
  - Factor B; Nitrogen rate, with 4 variants:
    - b1 - N0 - unfertilized (Control);
    - b2 - 60 kg/ha;
    - b3 - 80 kg/ha;
    - b4 - 120 kg/ha.
- In all experimental variants, except for Control variant, there was applied before seedbed preparation the complex fertilizer of type 16:16:16 in a rate of 250 kg/ha, assuring 40 kg/ha as active substance of N, P2O5 and K2O. In May (1-5 of May), the nitrogen rate according to the experimental variant was assured by applying the liquid fertilizer UAN (Urea Ammonium Nitrat Solution) containing 32% nitrogen.
- For each variant, the following determinations were performed at harvest: number of pods/plant; number of grains/plant; average number of grains/pod; grain mass/plant (g); Thousand Grains Weight (TGW) (g). Grains Yields (kg/ha), moisture content (U) (%) and Hectoliter Mass (MH) (kg/hl) were determined, as well as the content in lipids (%) and proteins (%).

### • Results and discussions

Soybean grains yields in 2023-2024



The influence of tillage soil and nitrogen rate on lipids and proteins content of soybean grains (2023-2024)

Tillage soil	Nitrogen rate (kg/ha)	2023		2024	
		Oil (%)	Proteins (%)	Oil (%)	Proteins (%)
V1- Plowing (25 cm + 2 disc harrows)	N0 (Control)	17.56	34.34	17.87	35.11
	N60	18.97	35.06	18.16	35.87
	N90	19.08	35.78	18.98	36.23
	N120	20.76	36.11	19.05	36.28
	Average	19.09	35.32	18.52	35.87
V2- Scarifying (35 cm + 2 disc harrows)	N0 (Control)	18.01	34.89	17.34	35.02
	N60	18.05	35.99	17.78	36.03
	N90	18.78	36.01	18.02	36.57
	N120	19.01	36.23	18.98	36.88
	Average	18.46	35.91	18.03	36.13
V3- Gruber Tiger (25 cm)	N0 (Control)	17.23	35.02	18.12	36.07
	N60	17.78	35.56	18.45	36.67
	N90	18.80	36.21	19.24	37.08
	N120	19.03	37.30	20.20	38.11
	Average	18.21	36.18	19.00	36.98
V4- Gruber Tiger (15 cm)	N0 (Control)	17.07	35.16	18.20	36.21
	N60	17.94	35.77	19.04	36.67
	N90	18.08	36.79	19.78	36.98
	N120	19.15	37.87	20.10	37.21
	Average	18.06	36.40	19.28	36.77
V5- Disc harrow (15 cm) (2 passes)	N0 (Control)	17.45	34.14	18.22	36.14
	N60	17.88	34.56	19.23	36.56
	N90	18.10	35.27	20.08	37.27
	N120	19.40	37.31	21.60	38.31
	Average	18.21	35.32	19.78	37.07

### • Conclusions

- The conventional tillage system had a positive response for 2023, given that the amount of precipitation in spring exceeded the average (350 mm) for the area by about 30 mm. In the dry year 2024, the minimum tillage system played an important role in conserving water in the soil in spring, which led to better plant growth and higher seed yields than in the case of conventional tillage.
- Nitrogen fertilization is important to increase the soybean yield, in the performed research the variant with 120 kg/ha nitrogen proved to have the most important impact on seed yield. Generally, in any tillage variant and climatic conditions, the increasing of the nitrogen rate was associated with a positive effect on the yield elements.