

## Assessing the Economic Benefits of Irrigating Rapeseed for Biodiesel Production in Romania

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### Abstract

This study evaluates the economic benefits of irrigating rapeseed crops for biodiesel production in Mihai Viteazu, Cluj County, Romania. The experimental plot is located at the southwestern edge of the Transylvanian Plain, within the lower section of the Aries hydrographic basin. A multifactorial experimental design was employed, featuring randomized subdivided plots that examined three key factors: water regime (two levels), fertilization (four levels), and rapeseed variety (three varieties). Each configuration was replicated three times, resulting in 72 experimental plots (2 x 4 x 3 x 3). The most favorable results were consistently associated with the irrigated and fertilized treatments, particularly the 150N variants of the two hybrids. Overall average profits were reported as 735.75 lei/ha for NK Caravel and 750.85 lei/ha for NK Technic, compared to 659.84 lei/ha for Dexter.

### Material and Methods

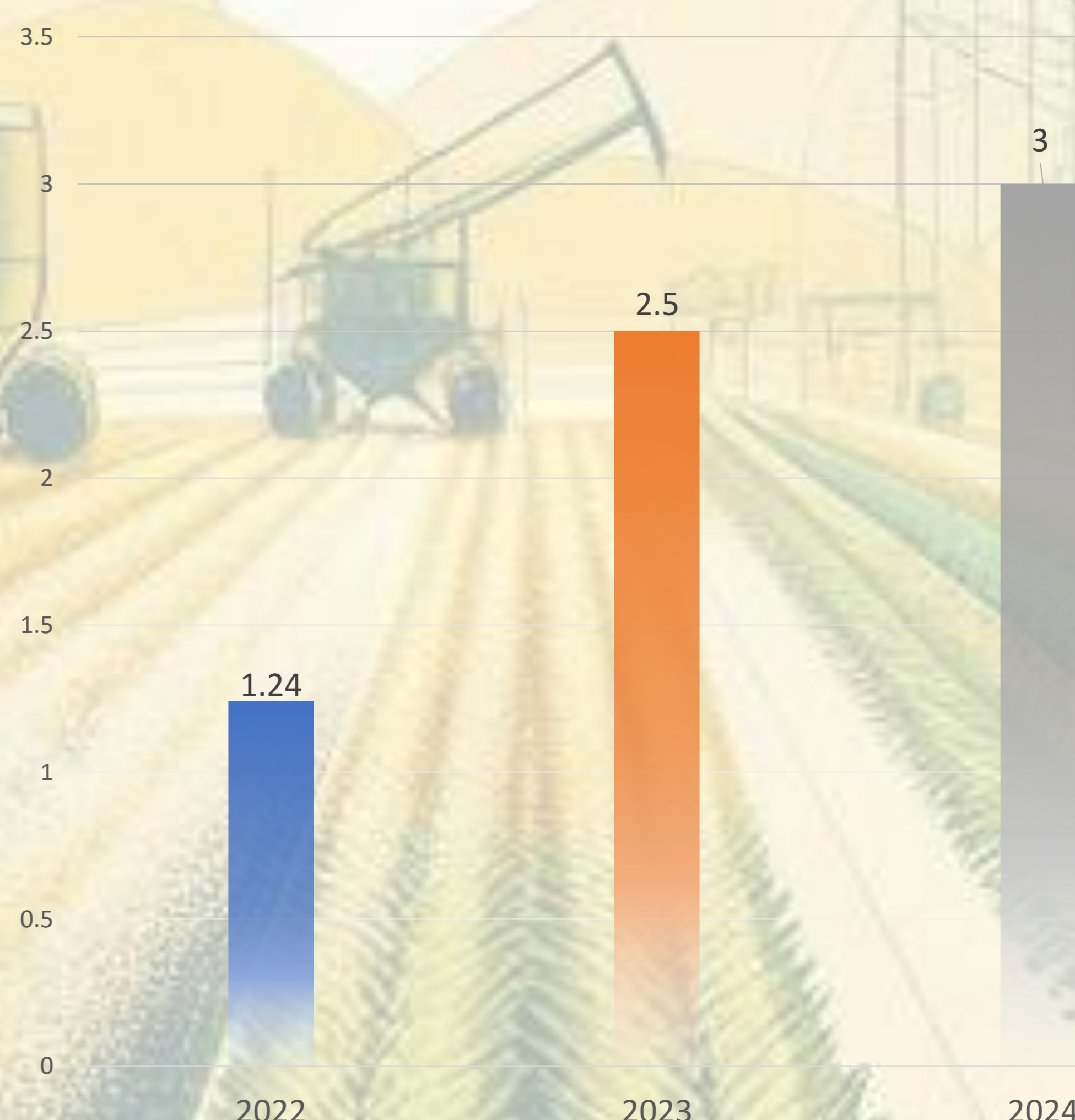
The cultivation of rapeseed was conducted on an experimental plot situated in Mihai Viteazu, Cluj County. This area is positioned at the southwestern edge of the Transylvanian Plain, specifically in the lower section of the Aries hydrographic basin. Mihai Viteazu is conveniently located along DN 75, approximately 45 kilometers from Cluj-Napoca. The geographical coordinates of this location are 46° 34' north latitude and 23° 46' east longitude, with an elevation ranging from 345 to 493 meters above sea level in relation to the Adriatic Sea. In this study, the comparative crops were established using a multifactorial experimental design that was completely randomized, incorporating subdivided plots. The first factor, A, refers to the water regime, which included two different levels; factor B pertains to fertilization, encompassing four distinct levels; and factor C involves the variety of rapeseed, with three varieties being selected. Each crop was replicated three times to ensure the reliability of the results. The irrigation for the plots was conducted using furrow methods, which are often employed to optimize water distribution in agricultural practices. The overall experimental design consisted of three repetitions (n = 3) for each comparative crop, analyzing a total of 24 different varieties calculated as (2 x 4 x 3). This led to a grand total of 72 experimental plots, computed as (24 x 3) (see Figure 5 for details). A summary of the experimental factors and their respective levels is provided in Table 2. For the statistical analysis of the data collected, the POLIFACT statistical software was utilized. This program specifically conducts analysis of variance (ANOVA) for completely randomized multifactorial experiments, allowing for a robust examination of the effects of various factors on the outcomes observed in the study.

### Results

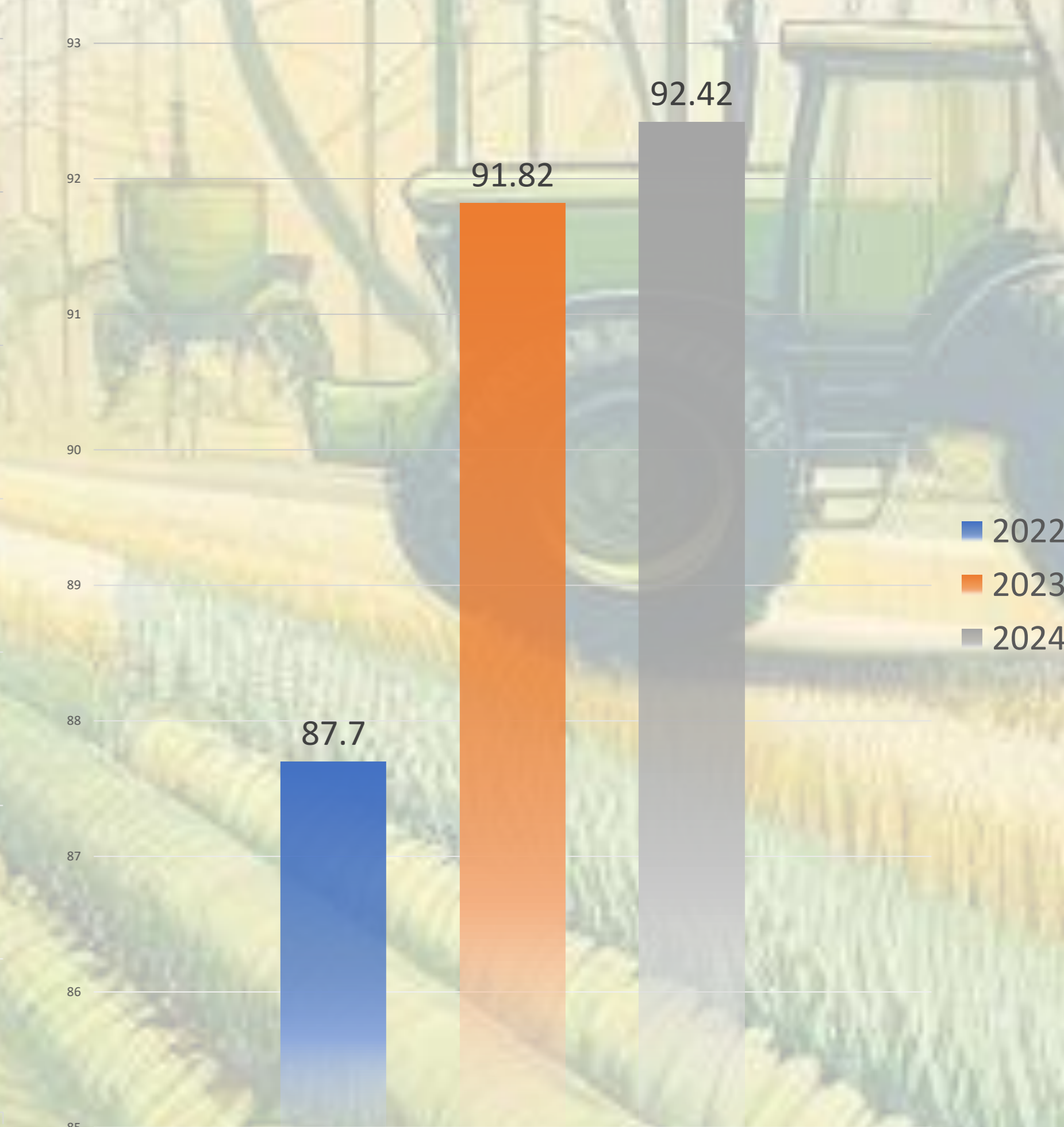
**Chart 1.** Profit/ha obtained with irrigation of the rapeseed crop, 2022-2024



**Chart 2.** Average price for the rapeseed crop, 2022-2024



**Chart 3.** Price of irrigation water delivery, 2022-2024



### Conclusions

- Irrigation has a significant impact on rapeseed production and, consequently, on the recorded profit. The profit from the experimental crop variants in Mihai Viteazu, Cluj, during 2022-2024, shows the following profit evolution from irrigated, fertilized, and non-fertilized crops:
  - 2022: Profit ranged between 425.79-976.58 lei/ha (Dexter), 440.99-1006.99 lei/ha (NK Caravel), and 445.79-1016.6 lei/ha (NK Technic). The profit from the two hybrids was roughly equal, with NK Technic being slightly superior.
  - 2023: Profit ranged between 98.83-434.45 lei/ha (Dexter), 138.93-524.02 lei/ha (NK Caravel), and 142.16-533.39 lei/ha (NK Technic). Again, the profit from the two hybrids was roughly equal, with NK Technic being slightly superior.
  - 2024: Profit ranged between 227.07-618.73 lei/ha (Dexter), 265.41-697.48 lei/ha (NK Caravel), and 277.91-732.32 lei/ha (NK Technic). The best results were obtained with the irrigated x fertilized 150N variants of the two hybrids.
- The irrigation applied in 2022 resulted in a profit of 836.96 lei/ha, in 2023 - 365.67 lei/ha, and in 2024 - 540.78 lei/ha. The best results were obtained in 2022 due to the highest production during the research years, good market prices for seeds, and the lowest irrigation costs. The weakest results were in 2023, which was not a good year for rapeseed due to low seed prices and high irrigation costs. The two hybrids achieved roughly equal average profits (735.75 lei/ha for NK Caravel and 750.85 lei/ha for NK Technic) compared to the Dexter variety (659.84 lei/ha).

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