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CORRELATION RELATIONSHIPS AND VARIABILITY OF IMPORTANT SAFFLOWER TRAITS UNDER DIFFERENT WEATHER CONDITIONS

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Safflower *(Carthamus tinctorius L.)* is a promising oilseed crop, characterized by high drought resistance and the ability to adapt to different climatic conditions. In connection with climate change and increasing temperatures in Ukraine, it is relevant to study the variability of economically valuable traits of safflower and their dependence on weather factors. The aim of the work was to establish the range of variability of traits of safflower collection samples, determine the influence of weather conditions on their formation, and analyze the correlations between the main morphological and productive indicators. The research was conducted in 2013, 2014, 2024, and 2025 at the experimental field of the Institute of Oilseed Crops of the National Academy of Sciences of Ukraine. Collection samples were sown in open field conditions, and the yield per plant, the thousand-seed weight, oil content, plant height, number of branches and heads, head diameter, and the height of attachment of the first branch were evaluated. The oil content was determined by extraction, and statistical analysis was performed using the Pearson correlation coefficient. Significant variability of the studied traits was observed. The yield per plant varied from 2.4 to 19.4 g, the thousand-seed weight from 37.2 to 67.7 g, the oil content from 24 to 34.8%. Samples with high yield and oil content were identified: Safflire, Gila and Mestniĭ 2. The highest thousand-seed weight was formed by the sample Bogatyr, which can be a source of seed size in breeding work. Significant correlations were found between yield and plant height (r = −0.41), as well as between yield and the height of attachment of the first branch (r = −0.43). A strong positive correlation was established between plant height and the height of attachment of the lower branch (r = 0.88). Analysis of weather conditions showed that the number of heads on a plant is positively correlated with the amount of precipitation in May and June, while an increase in temperature during this period negatively affects the formation of individual traits. The most favorable conditions for the development of safflower are cool and humid May and moderately warm June.

Keywords: trait, correlation, precipitation, air temperature, seeds, oil content, plant height, thousand seed weight

Introduction. Safflower (*Carthamus tinctorius*) is an annual herbaceous plant of the Asteraceae family. Safflower was formerly cultivated for its seeds and flowers, which were used to add color and flavor to food, in dyes, and in medicine. Recently, the plant has been cultivated primarily for its vegetable oil (Mîrzan et al., 2025).

Many studies are aimed at predicting the possibilities of growing individual crops in different climatic zones, or under climate change. In particular, in safflower, these ideas were connected and studied in terms of flavonoid content in combination with bioclimatic factors. In the study of Zeng et al., the accumulation of flavonoids and

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adaptive properties depended on average temperature (contribution 36.44%). (Zeng et al., 2022). The safflower genome was studied, in particular the genes that determine the synthesis of flavonoids. It was found that the same genes are responsible for drought resistance (Tan et al., 2025a; Tan et al., 2025b).

The genotypes differed in drought resistance, some of them showed better photosynthetic productivity and were restored after irrigation (Erdal, 2023). Safflower has great potential as a sustainable biofuel feedstock with drought resistance (Russo et al., 2026)

It is known that safflower has unique properties to adapt to salinity with various reagents. For example, a gene for tolerance to lead pollution has been established (Hong et al., 2023). The individual effects of salinity and drought on safflower seedlings are less harmful to plant development compared to the combined effects of these two stresses. (Kayacetin, 2022)

Currently, there is a lack of research on candidate genes associated with disease resistance in safflower, which hinders the development of disease-resistant safflower varieties (Ma et al., 2026)

Genetic variability of safflower is studied using molecular technologies (Giachino, 2023). The expansion of genetic variability also occurs using classical mutagenesis. Thus, several mutants were obtained with a significantly higher oleic acid content of 36.86%, oil content (up to 35.19%), and protein content in seeds (up to 22.51%) (Khatod et al., 2026).

Molecular markers have been established for genes that can increase the oil content in safflower (Deng et al., 2023). Significant genetic variability in oil, seed yield, and other agronomic traits was obtained by involving wild safflower species, and new useful ones were obtained (Majidi et al., 2024).

The direction of research on establishing correlations between different traits is very interesting. Correlation analysis showed that seed yield was influenced by plant height, thorniness intensity, inflorescence diameter and flower color as key traits. Plant height, thorniness intensity and number of days to the end of flowering had the most significant direct positive effect on the percentage of oil. This analysis also indicated a direct negative effect of oleic and linoleic acids (Bakhshi et al., 2025). However, it should be noted that some of the correlations may be due to the small diversity of the studied collection. Thus, in the study of Sajid et al. concluded that samples of prickly safflower had 1.2% and 16.3% more oil and linoleic acid content, respectively. (Sajid et al., 2024). The same study found that seed oil content, seed yield, and 1000-seed weight had the highest correlation.

Another analysis of correlation coefficients showed that leaf length, leaf width and primary branches per plant, together with 1000 seed weight and seed yield per plant, had a significant positive relationship and a direct effect on yield per plot. (Kebede et al., 2025). Correlation analysis in a large-scale study by Tonguç et al. found 45 correlations, four of which were positive and 7 of which were negative among themselves (Tonguç et al., 2023)

Interesting studies have been conducted on the study of roots and it was found that seed yield had a strong positive correlation with root length density (0.57) and root diameter (0.84) (Ganji et al., 2025).

Assessment of genotype-environment interactions is an important component of the process of variety selection for multi-environment traits. A set of 15 genotypes of winter safflower (Carthamus tinctorius L.) was evaluated for grain yield, compatibility, and yield stability in different environments under rainfed conditions.

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Analysis of variance showed significant variation in grain yield relative to the root mean square values of environments and genotypes (Zerehgar et al., 2023). Therefore, it is very important to control and involve environmental factors in the study of traits. Thus, in the study of Ali et al. Morphological traits showed an increase of 2.82-50.00% in response to nitrogen application.

Biological yield had a significant positive correlation with fresh shoot weight, root length, fresh root weight and number of leaves, while a significant positive correlation was also observed between carotenoids, chlorophyll a (chl a), chl b and total chlorophyll content under all treatments (Ali et al., 2024).

At the Institute of Oilseed Crops of the National Academy of Agrarian Sciences of Ukraine, we deal with genetic resources: we study and maintain collections. Long-term observations show interesting differences between samples and their characteristics. In addition, the entire modern world has been observing significant climate changes in recent years, so it was decided to combine these observations.

The goal of our study was to establish the range of variability of safflower collection traits, the influence of weather conditions on their formation, and the establishment of correlations between them.

Materials and Methods. The research was conducted in the experimental field in the nursery of the Institute of Oilseeds in 2013, 2014, 2024, 2025. Collection samples were sown in the open field. The soil was prepared in the fall by plowing and cultivating. Sowing was carried out after pre-sowing cultivation when the soil temperature reached +5 °C.

This is April 1-3. Sowing was carried out manually in a row method with a row spacing of 0.35 m and a distance between plants in a row of 10 cm. This sowing scheme corresponds to a plant density of 285 thousand plants per hectare. Crop care was carried out manually. Seeds for sowing experiments were obtained using individual insulators. Measurements and observations were carried out on at least five plants of each sample.

Oil content was measured according to DSTU 7577:2014, oil composition according to DSTU 30418-96. Statistical calculations were performed using Microsoft Excel (Schmuller, 2021). The correlation between the indicators was calculated using the Pearson coefficient. For a qualitative assessment of the correlation coefficients, the Chaddock scale was used. V. Where we were interested in the gradations: r = 0.3–0.5 – noticeable; r = 0.5–0.7 – moderate; r = 0.7–0.9 – high. The reliability of the correlation results was proven using the Student's t-test, at $\alpha = 0.05$ (Babiyenko et al., 2022).

Weather conditions varied considerably between the years of the study. Average temperatures over several decades are presented in Figure 1.

As you can see, the hottest summer was in 2024. 2013 and 2014 were distinguished by higher May temperatures than 2024 and 2025. As for precipitation, its amount is very uneven.

So, Fig. 2 shows that according to precipitation in 2024 and 2025, a significant shortage was observed in July and August. While the largest amount of precipitation in May was observed in 2025, it was two times less than the amount of precipitation in 2014. According to the hydrothermal coefficient, the years are arranged in this order from the driest to the wettest: 2025 (0.2), 2024 (0.3), 2013 (0.4), 2014 (0.6). A comparison of these years shows a real increase in temperatures and a decrease in precipitation in Zaporizhzhia.

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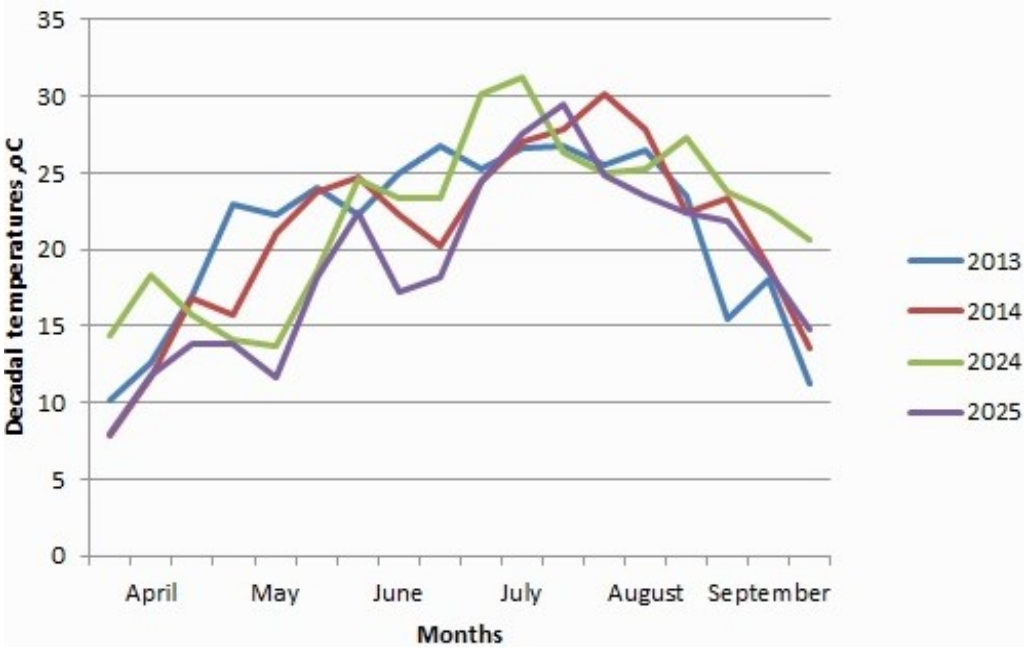

Fig. 1. **Decadal temperatures of the study years during safflower cultivation**
Source: developed by the author

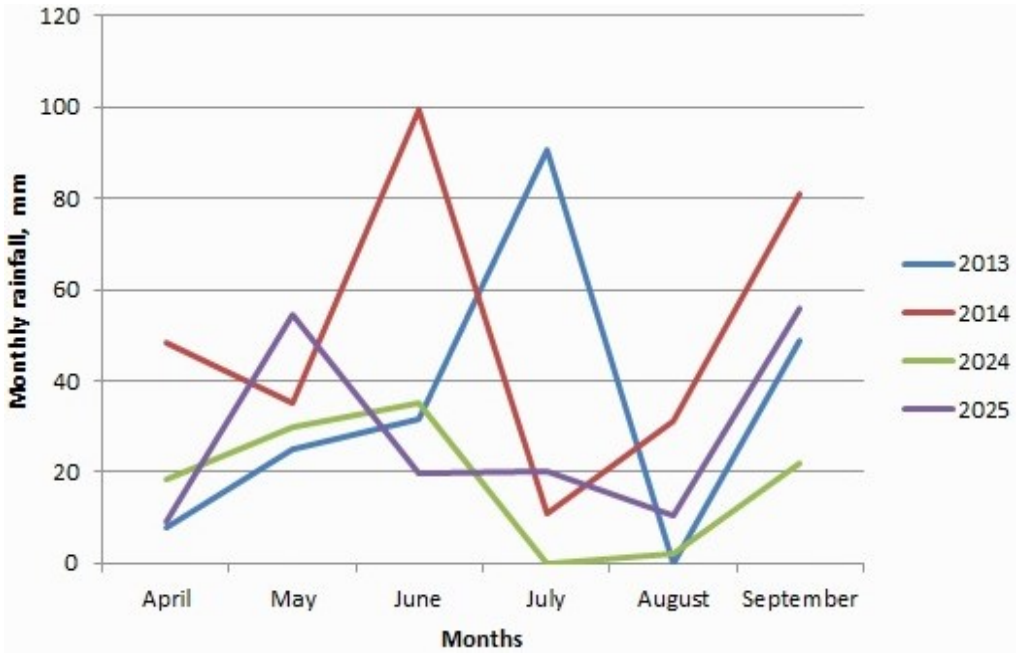

Fig. 2. **Monthly rainfall during safflower growing years**
Source: developed by the author

Results and Discussion. The average obtained indicators of safflower samples for three years are presented in Table 1.

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Table 1

Average indicators of breeding traits of safflower collection samples (2024–2025)

ACCENAME	ACCENUMB	Yield per plant, g	Mass of a thousand seeds, g	Oil content, %	Plant height, cm
Saflor 210	UE0900007	7.7±3.70	46.8±1.49	26.3±1.02	104±2,2
Solnechnyy 2	UE0900009	8.3±4.68	44.6±0.22	25.3±1.06	83±1,9
C-1 N3	UE0900010	6.6±2.21	39.2±3.66	30.3±0.10	90±2,0
C-1 N4	UE0900011	5.5±1.31	43.7±0.63	33.5±0.70	97±1,6
C-1 N5	UE0900012	6.7±1.58	42.1±1.01	32.4±0.91	95±1,2
Mestnyy 2	UE0900015	18.1±5.27	43.2±1.36	34.8±0.29	86±2,2
Solnechnyy 3	UE0900017	12.4±2.49	57.9±2.16	29.5±0.57	91±1,8
Krasnotsvetushchiy	UE0900019	12.9±3.19	39.6±0.28	30,2±0.86	93±2.3
Obrazets 14	UE0900020	12.6±2.11	41.6±1.22	29.9±0.78	93±2.0
K69 (K-569)	UE0900023	13.5±3.22	37.2±0.81	31.3±0.59	83±2.6
K120 (K-250)	UE0900024	13.1±4.09	39.5±1.77	28.7±1.02	98±2.0
K140	UE0900025	12.6±2.95	38.8±2.29	27.6±0.69	90±2.3
K201	UE0900026	10.2±4.9	43.7±3.69	27.1±0.09	88±1.3
K515	UE0900027	12.1±4.87	56.2±3.92	29.3±1.03	90±2.2
Belotsvetkovyy ne kolyuchiy	UE0900035	11.5±3.51	38.3±1.64	32.5±1.02	86±3.1
Rozochka	UE0900038	4.8±1.17	42.0±1.88	31.5±0.65	83±2.2
Medovyy	UE0900039	6.3±1.54	53.1±2.48	26.8±0.58	89±4.8
Ogonok	UE0900040	8.0±3.1	61.6±1.65	28.5±0.74	75±2.7
L64	UE0900041	8.5±3.24	43.4±0.74	33.2±0.29	102±2.7
Rassvet	UE0900042	3.5±0.98	57.0±2.73	24.3±0.55	92±2.2
Iskorka	UE0900043	47.±1.18	46.0±1.3	31.8±0.6/	85±2.8
Kurchavyy	UE0900044	4.5±1.74	54.7±8.32	30.7±0.72	87±1.4
129/к	UE0900045	5.4±1.65	44.3±2.52	29.7±0.44	99±3.7
157/1	UE0900046	19.4±5.03	58.1±6.79	31.9±0.86	87±2.1
89/1	UE0900047	6.5±1.6	58.0±0.41	32.1±1.03	83±1.4
Bogatyr'	UE0900048	2.4±0.66	67.7±4.66	30.3±0.18	108±3.4
BPK 2	UE0900049	7.7±1.95	51.8±0.55	30.0±0.52	95±2.6
Herkules	UE0900050	14.1±3.5	64.5±1.22	32.6±0.47	93±1.8
Salyut	UE0900051	5.9±2.04	41.6±0.75	30.9±0.39	104±3.9
Dobrynya	UE0900053	9.6±2.71	52.4±3.55	25.0±0.75	90±2.3
K504	UE0900058	7.5±3.5	55.0±0.9	30.4±0.36	92±1.8
K501	UE0900059	9.8±2.99	49.9±1.4	30.7±0.04	105±2.6
K497	UE0900060	15.4±5.32	47.4±0.82	27.0±0.17	95±1.4
K331 Orange de Marocco	UE0900062	17.9±6.97	44.9±0.94	28.4±0.65	89±0.9
K549 Safflire	UE0900063	14.9±7.97	46.7±1.31	33.5±0.77	81±3.7
K533 Gila	UE0900064	15.2±8.65	50.9±1.69	33.5±0.99	83±1.4

Source: developed by the author

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The range of variability in individual characteristics was quite large. Thus, the yield from one plant ranged from 2.4 grams to 19.4. Unfortunately, some samples had large errors of 5 to 7 grams, especially in the most productive samples: 157/1, Orange de Marocco, Safflire, Gila, Mestniĭ 2. These samples are well-known varieties or have their own selection origin. The thousand-seed weight had a not so significant variation from 37.2 to 67.7 grams. Statistically, these data are more stable and have relatively small errors. The oil content of the seeds turned out to be even less variable from 24% to 34.8%. Measurements of oil content by samples were quite stable within a little more than 1 percent. This helps to identify really interesting high-oil samples, which are half of the same high-yielding Mestniĭ 2, Safflire, Gila and C-1N4, L64. In published studies, the highest oil content of the created mutant was 35%, which is practically the same as our best samples (Khatod et al., 2026).

Morphological feature - plant height varied from 75 to 108 cm. The tallest specimens had low yield indicators and rather shallow seeds. The number of branches varied from 4 to 18.7 pieces. The number of heads per plant from 6 to 31 pieces. And the diameter of the largest head from 2.4 to 3.4 cm. The height of attachment of the first branch varied from 23 to 66 cm. General observations allow us to distinguish as potentially interesting specimens for breeding: Mestniĭ 2 which has the highest yield, the largest head diameter and the highest oil content. But its seeds are quite small, only 43 grams of thousand-seed weight.

A very interesting contrast is the Bogatyr specimen. It has a very small yield of 2.4 grams, the largest plant height of 108 cm, the largest seeds with a thousand-seed mass of 67.7 g with a small number of heads and branches. This specimen also begins to bloom later than the main mass. However, the lack of moisture or fungal diseases, which can only occasionally affect early specimens, do not allow the formation of a yield later, for example, Bogatyr. Therefore, for further selection, it is desirable to involve it as a source of large seed size in crossing and combine early maturity with large seeds.

Valuable sources of oiliness and yield were the varieties Safflire, Gila. The specimens we obtained have already undergone several reproductions from collectors and cannot claim full authenticity, but they indicate a real era of safflower breeding in other parts of the world. The authors present these varieties as those that can provide a yield of more than 4 tons per hectare, but as we see in our conditions it is up to 3.75 tons per hectare. in terms of 250 thousand plants per hectare.

The specimen Belotsvetkovyy ne kolyuchiy with the largest number of heads and branches (Table 2) with quite moderate other important indicators, this is due to the fact that it has a multi-level formation of heads on branches of the second and even third orders, where the seeds do not have time to form, since it blooms late and either does not have enough moisture, or the plants are affected by a fungus. In our area, humid growing conditions are quite an exceptional phenomenon.

According to the obtained data, the correlation coefficients of all the traits presented in Table 1 were calculated. Only three reliable correlations were established. The correlation coefficient of yield and plant height was -0.41, and yield and lower branch attachment height was -0.43. A high correlation dependence of 0.88 was established for the traits of plant height and lower branch attachment height. These correlations show that plants that are smaller in height have the highest yield. While in the studies of other scientists Bakhshi et al. A high positive correlation of height with yield was established (Bakhshi et al., 2025). But it should be emphasized that there are no real low-growing specimens in our collection, therefore the established correlation concerns plants with normal plant height. As for precocity, in our experiment the flowering date of 50% of plants was always successfully determined. The range of variability in individual years was up to 14 days.

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Table 2

Average indicators of morphological characteristics of safflower collection samples (2024–2025)

ACCENAME	ACCENUMB	Number of branches on the central stem, pcs.	Number of heads on the plant, pcs.	Head diameter, cm	Height of attachment of the 1st branch from the bottom, cm
Saflor 210	UE0900007	7.7±0.7	8±0.6	2.9±0.20	37±4.7
Solnechnyy 2	UE0900009	14.7±0.9	20±1.2	3.2±0.10	23±2.9
C-1 N3	UE0900010	6.7±0.3	11±2.3	2.7±0.06	45±6.4
C-1 N4	UE0900011	13.3±0.9	15±1.2	2.8±0.04	41±4.5
C-1 N5	UE0900012	11.7±4.2	16±8.0	2.6±0.08	39±5.2
Mestnyy 2	UE0900015	12.0±1.2	14±2.3	3.3±0.05	25±2.4
Solnechnyy 3	UE0900017	7.3±0.9	12±3.2	3.1±0.06	21±3.9
Krasnotsvetushchiy	UE0900019	11.3±0.9	13±0.9	2.7±0.06	41±3.5
Obrazets 14	UE0900020	10.7±0.0	14±0.0	2.8±0.14	36±4.4
K69 (K-569)	UE0900023	14.0±1.5	22±1.2	2.7±0.08	31±2.9
K120 (K-250)	UE0900024	8.7±0.7	15±1.5	2.5±0.07	43±4.1
K140	UE0900025	12.7±1.8	14±1.5	2.8±0.06	35±5.3
K201	UE0900026	8.7±0.7	13±1.5	2.8±0.04	36±4.9
K515	UE0900027	8.7±1.8	13±2.5	3.1±0.06	46±6.1
Belotsvetkovyy ne kolyuchiy	UE0900035	18.7±1.8	31±1.9	2.8±0.07	40±6.6
Rozochka	UE0900038	7.3±3.3	8±3.0	2.7±0.07	47±6.7
Medovyy	UE0900039	11.7±0.9	16±0.6	2.5±0.03	49±4.2
Ogonok	UE0900040	6.0±0.0	8±0.7	2.9±0.07	42±4.0
L64	UE0900041	5.3±0.7	7±0.9	2.7±0.04	45±8.4
Rassvet	UE0900042	5.3±0.3	6±0.3	2.5±0.03	50±8.5
Iskorka	UE0900043	5.3±0.7	7±0.7	2.4±0.06	51±7.5
Kurchavyy	UE0900044	6.3±0.3	7±0.6	2.4±0.08	30±11.3
129/к	UE0900045	7.0±1.0	12±1.5	2.9±0.07	42±14.4
157/1	UE0900046	12.7±0.9	14±0.6	2.7±0.09	36±3.6
89/1	UE0900047	5.7±0.3	6±0.3	3.1±0.13	46±5.9
Bogatyr'	UE0900048	6.3±0.7	6±0.7	2.7±0.15	66±9.5
BPK 2	UE0900049	4.0±0.6	4±0.6	3.4±0.06	49±7.9
Herkules	UE0900050	10.7±0.7	15±0.9	3.0±0.07	45±3.0
Salyut	UE0900051	8.3±1.2	10±2.3	2.8±0.20	68±7.3
Dobrynya	UE0900053	9.0±1.5	13±3.7	2.6±0.05	49±4.7
K504	UE0900058	8.7±0.3	14±2.3	2.6±0.06	56±5.1
K501	UE0900059	7.0±0.6	12±3.6	2.6±0.08	51±6.9
K497	UE0900060	7.7±0.3	9±0.6	2.9±0.05	52±6.3
K331 Orange de Marocco	UE0900062	6.3±0.4	8±0.0	2.5±0.04	42±5.7
K549 Safflire	UE0900063	8.0±1.0	12±2.7	2.4±0.10	35±4.1
K533 Gila	UE0900064	5.3±0.9	7±1.2	2.7±0.08	43±6.5

Source: developed by the author

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But more often the difference between the earliest and the latest is 8–10 days. This indicator did not show significant correlations with other characteristics.

Each year has its own characteristics, in the amount of precipitation and temperatures that can affect plants, changing their quality and quantitative measurement of traits. So, in 2016, 53 samples were studied. In particular, the composition of the oil and oiliness were determined. The correlation analysis of the results of 2016 showed the presence of several reliable correlations of traits, which are confirmed by world-famous studies by Bakhshi et al. (Bakhshi et al., 2025). This is a high correlation coefficient between the content of oleic and linoleic acids in oil of 0.99. A noticeable correlation coefficient between myristic and palmitic acids of 0.48. But studies of the composition of the oil were not conducted annually, so indicators were calculated for this parameter only for 2016. Also, according to the results of this year's studies, a moderate correlation between the number of lateral branches and heads with a coefficient of 0.51 was confirmed. Also, a moderate coefficient of 0.53 was observed between the number of leaves and plant height.

The fact that we have not obtained so many high and noticeable coefficients between safflower traits compared to the presented world achievements most likely indicates a rather narrow genetic basis of the collection, which numbers a little more than 50 samples. While other world studies deal with much larger volumes up to several thousand, narrowing them to acceptable sizes for breeders of 300-350 samples (Giachino, 2023). Therefore, it is still a task for the future to expand the genetic base of safflower for use in Ukraine.

In recent years, there has been a lot of talk about significant climate warming. In particular, about the development of drought in Ukraine. Safflower is one of the most arid crops that was grown in semi-deserts and without irrigation. Therefore, we decided to assess the impact of weather conditions on the main indicators of safflower.

One of the most important indicators that shows the condition of a plant is the size and fullness of its seeds. They can be judged based on the thousand-seed weight. This indicator is often studied and has fairly stable indicators. Figure 3 shows the thousand-seed weight over the years of research in 14 different samples of the collection.

The graph shows that some samples have exceptions, these are the samples Bogatyr and Salyut, which showed seeds with a lower mass of a thousand seeds in 2025 than in 2024 and 2014. For other samples, the highest mass of a thousand seeds was observed in 2025. Accordingly, this year stood out as the driest of the four presented. So why do we observe the highest mass of a thousand seeds. Figure 1 shows that 2025 was distinguished by a cooler and wetter May and very dry and hot summer months. This is what probably affected the quality of the seeds.

One of the annually studied features is the height of plants, which also characterizes the condition and development of plants. The height data for 14 samples are presented in Fig. 4. It can be seen that mainly taller plants were observed in 2024 and 2025 when May was cool and humid. But ten years ago, in 2014 and 2013, precipitation was in June and July and they did not affect the height of plants, it was much lower.

Figure 5 shows the number of heads by individual years of research, it was found that only in 2014 their number was significantly higher than in other years of research. If we look specifically at the precipitation presented in Fig. 2, it is clear that only 2014 had a large amount of precipitation in June when branches and lateral heads were formed.

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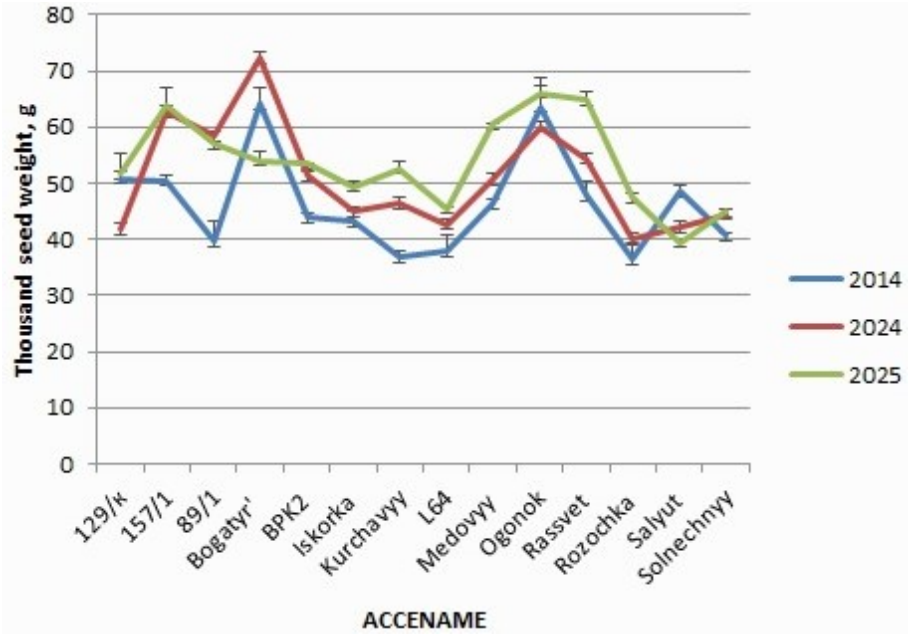

Fig. 3. **Mass of 1000 safflower seeds by year**

Source: developed by the author

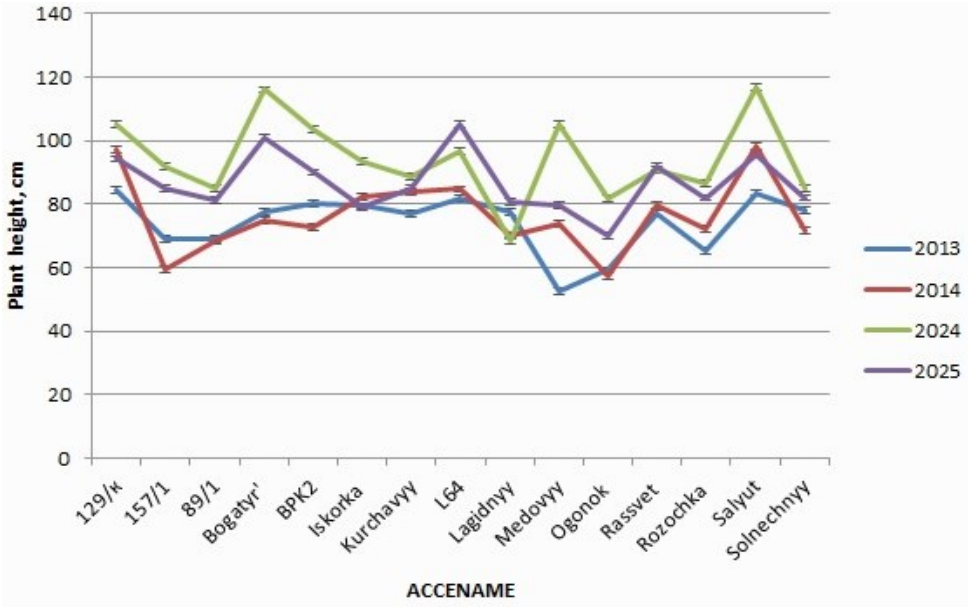

Fig. 4. **Safflower plant height by years of research**

Source: developed by the author

These observations require scientific evidence. We calculated averages from a collection of the same samples and calculated the correlation coefficients of these averages with temperature and precipitation during important growing seasons. The most interesting results are presented in Table 3.

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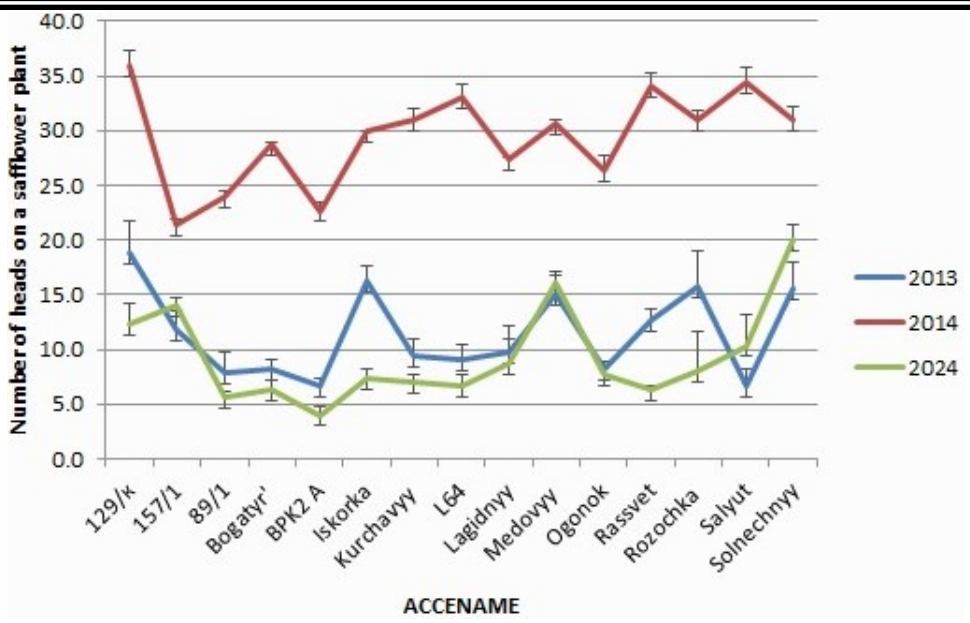

Fig. 5. **Number of heads on a safflower plant in different years of research**
Source: developed by the author

The table shows that the number of heads on safflower plants is positively and highly correlated with the amount of precipitation in May and June, when their formation and development are observed. While the overall average temperature during the growing season has a high negative correlation. It can be assumed that this is the influence of June temperatures, but this coefficient is not statistically significant.

Table 3

Correlation coefficients of average characteristics of safflower collection with weather conditions of the year

Weather factor	Period-month	Number of heads, pcs.	Head diameter, cm	Plant height, cm	Oil content, %	Mass of a thousand seeds, g
Temperature, ° C	Average for the growing season	-0.87*	-0.27	-0.17	-0.82*	-0.85*
	May	0.23	-0.90*	-0.78*	-0.78*	-0.87*
	June	-0.89	-0.24	-0.23	-0.79*	-0.77*
	July	-0.53*	0.95	0.83*	0.54*	0.12
Precipitation, mm	Amount for the growing season	0.91*	-0.82*	-0.37	0.01	-0.66*
	May	0.82*	0.3	0.23	0.87*	0.84*
	June	0.99*	-0.44	0.13	0.54*	-0.89*
	July	-0.31	-0.69*	-0.95	-0.99	0.57*

Notes:* Reliable when p = 0,05.
Source: developed by the author

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Head diameters appear to have only high negative correlations with May and July temperatures. Plant height in our studies had a high positive correlation with July temperatures and a high negative correlation with May temperatures.

Safflower seed oiliness had high negative correlations with May and June temperatures and a high positive correlation with May temperature and a notable one with June temperature.

Thousand-seed weight had high negative correlations with temperatures in May and June and rainfall in June and July. At the same time, safflower thousand-seed weight had high positive correlations with rainfall in May.

Summarizing all the above calculations, it becomes clear that for a more complete development of the potential of safflower plants, a cool and humid May and not hot June are required. The presence of precipitation in June has a positive effect on the number of seeds and yield, but a negative effect on oil content. In July, a high effect of high temperatures on oil content and height has been proven, while July precipitation either has a moderate effect on the characteristics, or its effect has not been proven.

Therefore, considering the temperatures and conditions of the Zaporizhia region, which practically never has significant precipitation in July and August, and in which the temperature has been rising in recent years, such conditions are generally well suited to safflower. To take advantage of spring moisture, you can start sowing safflower earlier than we usually do.

Conclusions. A number of high correlations were established: negative average temperatures in May with the following characteristics: head diameter, plant height, oil content, thousand-seed weight; temperatures in June with the following characteristics: number of heads, oil content, thousand-seed weight. Positive high correlation coefficients of precipitation in May with the following characteristics: number of heads, plant height, oil content, thousand-seed weight. High positive correlation of precipitation in June with the number of heads on a plant and high negative correlation of precipitation in June with the thousand-seed weight.

The variability of safflower traits during four-year studies was established and the sources of oiliness and yield were identified: Safflire, Gila. Sources of greater yield of thousands of seeds Sonyachny 3, Hercules and Bogatyr.

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КОРЕЛЯЦІЙНІ ЗАЛЕЖНОСТІ І МІНЛИВІСТЬ ВАЖЛИВИХ ОЗНАК САФЛОРУ У ЗВ'ЯЗКУ З РІЗНИМИ ПОГОДНИМИ УМОВАМИ

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Сафлор *(Carthamus tinctorius L.)* є перспективною олійною культурою, яка характеризується високою посухостійкістю та здатністю адаптуватися до різних кліматичних умов. У зв'язку зі змінами клімату та зростанням температури в Україні актуальним є дослідження мінливості господарсько–цінних ознак сафлору та їх залежності від погодних факторів. Метою роботи було встановити розмах мінливості ознак колекційних зразків сафлору, визначити вплив погодних умов на їх формування та проаналізувати кореляційні зв'язки між основними морфологічними й продуктивними показниками. Дослідження проводили у 2013, 2014, 2024 та 2025 роках на дослідному полі Інституту олійних культур НААН. Колекційні зразки висівали у відкритий ґрунт, оцінювали врожайність з рослини, масу тисячі насінин, олійність, висоту рослин, кількість гілок і кошиків, діаметр кошику та висоту прикріплення першої гілки. Вміст олії визначали методом екстракції, статистичний аналіз проводили із застосуванням коефіцієнта кореляції Пірсона. Встановлено значну мінливість досліджуваних ознак. Урожайність з рослини варіювала від 2,4 до 19,4 г, маса тисячі насінин – від 37,2 до 67,7 г, олійність – від 24 до 34,8%. Виділено зразки з

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високими показниками врожайності та олійності – Safflire, Gila та Местний 2. Найбільшу масу тисячі насінин сформував зразок Богатир, який може бути джерелом крупності насіння у селекційній роботі. Виявлено достовірні кореляційні зв'язки між врожайністю та висотою рослин (r = −0,41), а також між врожайністю і висотою прикріплення першої гілки (r = −0,43). Встановлено сильну позитивну кореляцію між висотою рослин і висотою прикріплення нижньої гілки (r = 0,88). Аналіз погодних умов показав, що кількість кошиків на рослині позитивно корелює з кількістю опадів у травні та червні, тоді як підвищення температури в цей період негативно впливає на формування окремих ознак. Найсприятливішими для розвитку сафлору є умови прохолодного та вологого травня і помірно теплого червня.

Ключові слова: ознака, кореляція, опади, температура повітря, насіння, вміст олії, висота рослин, маса тисячі насінин

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