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Cultivation of a new culture of technical *Cannabis* in Uzbekistan

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ABSTRACT

This article describes that over the course of three years from 2022 to 2024, research was conducted on the culture of industrial *cannabis* in the soil and climatic conditions of the Khavast district of the Syrdarya region, where 5 cultivars were studied in a collection nursery. The agrochemical analysis of the soil, phenological observations, and biometric measurements were studied. Indo-selections were conducted in the nursery of the competitive test and 4 selections were studied. As a result, the productivity of technical *cannabis* varieties were studied in comparison with the standard Rodnik variety.With sufficient irrigation and observance of agrotechnology of cultivation, it is quite possible to successfully cultivate on weak and medium-saline soils. Breeding work has been carried out by the method of individual selection of technical *cannabis* plants with the necessary improved characteristics for further research in order to create new local varieties for our Republic.

Figures : 04 References : 32 Tables : 03
KEY WORDS : Industrial hemp, Plants, Seeds, Soil, Varieties.

Introduction

At present, on the basis of this Law, Resolution No. 770 of the Cabinet of Ministers of the Republic of Uzbekistan dated December 7, 2020 “On measures to streamline the use and cultivation of the *Cannabis* plant for industrial purposes not related to the production or manufacture of narcotic drugs and psychotropic substances” has been developed.

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We thank all the workers, agronomists and the administration of the agro-industrial cluster in the Syrdarya region of RS Success Agro LLC for their support and valuable experience in launching experiments on the farm territory.

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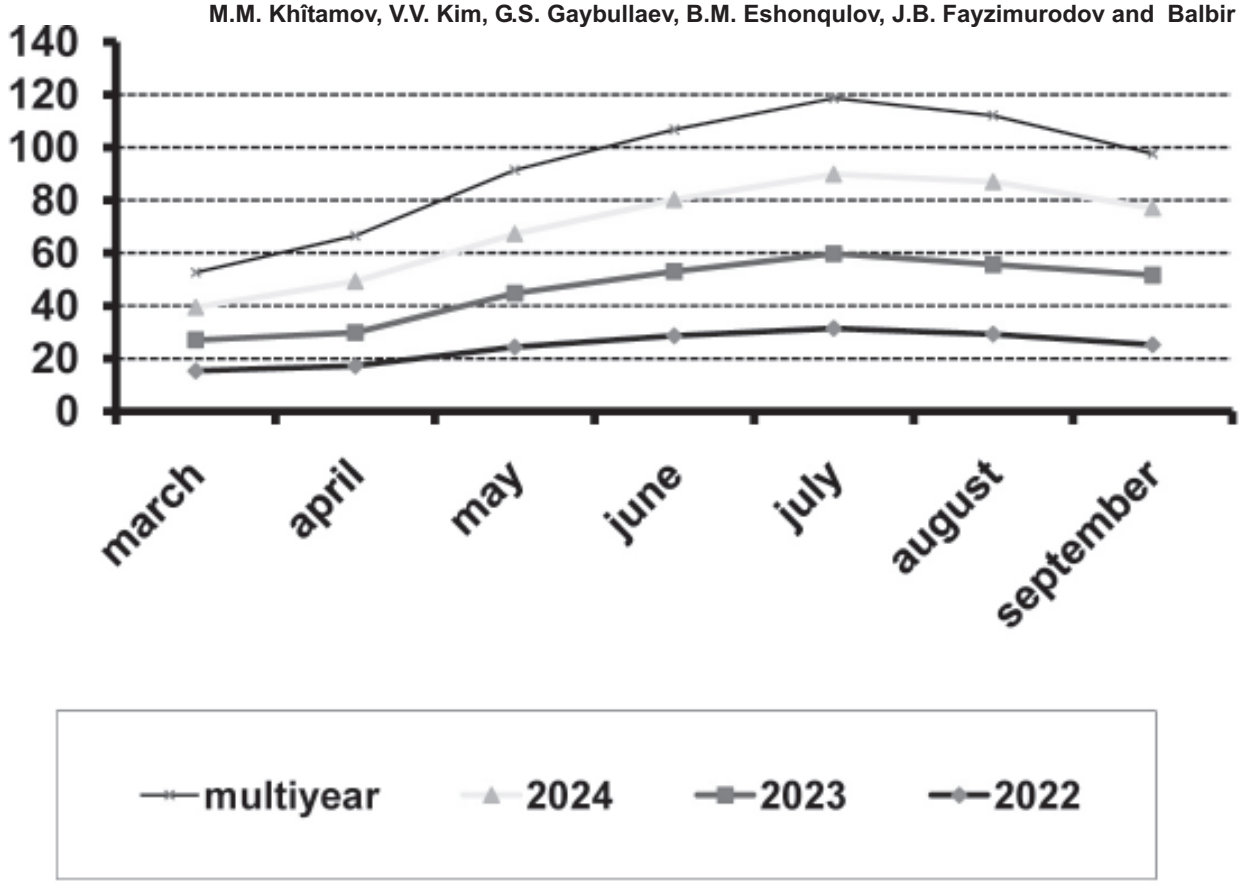


Fig.1: Average daily air temperature during the research period in 2022-2024. compared to the long-term average.

According to the resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated June 18, 2019 "On measures to create an agro-industrial cluster in the Syrdarya region", RS Success Agro LLC, owned by the Emirati company Industrial Innovation Group LLC, was established[11-14].

In 2024, according to the state-owned project "Selection and creation of new varieties of technical *cannabis* for cultivation in the soil and climatic conditions of the Republic", four cultivars were planted in the nursery of the competitive test in comparison with the standard variety Rodnik[6].

Cannabis belongs to the family Cannabinaceae. (hemp) *Cannabis sativa* hemp is an annual bast-fiber plant cultivated to produce fiber and seeds.

Hemp is an annual, usually dioecious plant, and monoecious forms are also found. The duration of the growing season, depending on the geographical type of cannabis, is 60-130 days. *Cannabis* grows fast. 10 days after the appearance of seedlings, *cannabis* plants reach a height of 30-35 cm. In the next 20-30 days, it grows slowly, and in the following days, an increase of 4-5 cm begins. During budding and flowering, the increase is 5-8 cm, which contributes to the formation of up to 75% of the aboveground mass[3; 6].

Technical *cannabis* does not have any psychotropic effects, unlike the subspecies of narcotic marijuana. Industrial varieties contain less than 0.1% tetrahydrocannabinol (THC), which causes a psychotropic effect (10).The cultivation of industrial hemp yields crops in the form of seeds and tops. Hemp oil is squeezed from the raw seeds. It is obtained with a greenish tinge of light or dark tones.

Today, technical *Cannabis* is considered among substitutes for cotton and synthetic materials, not only in the textile industry, but also in automotive, aviation, and shipbuilding, in the medical, space, defense, pulp and paper, construction, and sports goods industries[3].

Common seed hemp is an annual plant. Morphologically, the root, stem, leaves, flowers, and fruit of dicotyledonous *cannabis* are similar to monocotyledonous *Cannabis*. The inflorescence of monoecious *cannabis* depends on the sexual type:

a. Masculinized -loose paniculate inflorescence;
b. Ideal monoecious plant -inflorescence seed head;
c. Monoecious plant with a predominance of male flowers over female flowers -inflorescence seed head;

TABLE-1: Agrochemical analysis of the soil of the experimental site before sowing technical *cannabis* varieties

Horizon, cm	Humus, %	The content of gross forms,%			Content of mobile forms, mg/kg			
		N	P	K	$N\text{-}NH_4$	$N\text{-}NO_3$	P_2O_5	K_2O
0-15	0,67	0,1535	0,276	2,20	13,5	10,9	5,41	145
15-30	0,46	0,1330	0,220	1,75	12,4	8,2	11,7	98

d. Monoecious feminized palm -inflorescence seed head;

e. The usual flower is the inflorescence of the seed head.

The plant actively absorbs greenhouse gas, according to experts, 1 hectare of *cannabis* can replace 4 hectares of forest. Hemp fiber is a durable vegetable fiber, and in addition to hemp, ropes, and coarse linen, high—quality clothing, shoes, and underwear are made from it. The wear resistance of such clothes and shoes is quite high[11-14]. *Cannabis* is divided into 3 types: northern, Central Russian and southern. Central Russian *cannabis* plants have a height of about 1.25-2m, leaves of medium size, with a number of fractions from 5 to 9. The growing season is 80-120 days. The seeds are light gray; the weight of 1000 seeds is 13-18 g.[6].

The leaf of *Cannabis* consists of a petiole and a plate. According to the shape of the leaf blade, most *cannabis* leaves belong to complex leaves. The number of lobes and the size of the leaf plates are, to some extent, a varietal feature. The most developed leaves of the Central Russian varieties are 9-11, and sometimes 13 lobes. The color of the leaves varies from light to intense green, depending on the variety and growing conditions. The specific gravity of the stem is 60-65% of the total dry weight of the plant. The remaining 30-45% are roots, leaves and seeds. This ratio is approximate and depends on different growing conditions. At a young age, the stem of *cannabis* is soft, juicy, herbaceous, covered with glandular hairs, becomes woody with age, changes its shape, which changes from rounded to hexagonal from the base to the middle, and to tetrahedral to the top. The length of the hemp stem and its diameter within the same variety vary greatly depending on the growing conditions and the direction of the crop.

The stem of *cannabis* is a complex complex of tissues differentiated by position in the stem, structure and functionally it consists of epidermis, collenchyma, cow parenchyma, primary bast fibers, bast parenchyma, conductive tissue, cambium, wood, core[8].

The root system of *cannabis* consists of a main taproot and lateral roots. From the main root there are roots of the first and second order. The main root penetrates into the soil to a depth of 2 m or more, and the lateral roots of the first order - up to 80 cm. Compared to the above-ground mass, the *cannabis* root system is poorly developed, which is one of the reasons for the high demands of *cannabis* on soil fertility[11-14].

The male flower consists of a pedicel, a five-leaved yellow-green perianth and five stamens with long anthers attached to thin filaments. The female flowers, as well as the male ones, are located at the base of the branches coming out of the leaf axils. The female flower is surrounded by a case-shaped bract, from which only the columns of the pistil stand out. The pistil consists of two thin colorless stigmas fused at the base, and a single-nest ovary formed from two carpels, in the middle of which is an ovule. Female cannabis flowers are small; the beginning of their flowering is determined by the exit of the stigmas by 1-2 mm of the peduncle to the outside.The inflorescence is covered with small, loose tassels on the side branches and at the top of the stem. The inflorescence of the uterus is the seed heads located in the axils of the leaves[10].

Flowers and leaves are rich in valuable phytochemicals (cannabinoids, terpenes and polyphenols) that contribute to the health or treatment of those who use them[17].

High biomass indicators (6-12 t/ha) allowed us to consider hemp as a promising crop for producing biofuel[28]. The yield of cellulose from 1 hectare of hemp is 5-7 times higher than the increase in wood from 1 hectare of forest, and the quality of cellulose from hemp is much higher than that of wood[20,21]. During the Soviet period, hemp farming was a major supplier of raw materials for the textile industry. In addition to fiber, hemp produces seeds[4,20,21], from which valuable vegetable oil is obtained[19;26] and oilcake, as well as medicines. Hemp

TABLE-2: Productivity of industrial hemp varieties in 2024

Variety	Weight per plant, g				Fiber content per plant	
	seeds		stems			
	g.	± to St. %	r.	± to St.%	%	± to St.
St. Rodnik	1,26	100	13,2	100	21,3	100
L 1-23	0,53	42	14,7	111	25,7	121
L 2-23	0,85	67	14,1	109	23,6	110
L 3-23	0,72	57	13,5	102	22,8	107
L 4-23	0,64	51	12,3	93	23,0	108
Σ	4,0		67,8		116,4	
X	0,8		13,6		23,3	
$HCP_{0,5}$	*0,21*		*0,16*			

oil, in its fatty acid composition, belongs to the best edible oils and belongs to the linoleic-linolenic group. Linoleic acid has a positive effect on the human immune and hormonal systems, removes radionucleotides from the body, prevents the accumulation of cholesterol and normalizes lipid metabolism[22].

Hemp seeds contain upto 38% drying oil, 18-23% protein, 20% starch, 15% fiber, 4-5% ash[26;23].

The value of hemp oil is determined by the very high content of the gamma-tocopherol isomer - 85.2%, therefore hemp is one of the best sources of industrial production of gamma-tocopherol of natural origin for the needs of the pharmaceutical industry in antioxidants [29]. The wood of stems, bonfire, is successfully used for the production of artificial fibers, paper and building materials[9;25]. since it is known that in hemp stems the cellulose content reaches 45-58%. Consequently, using it, it is possible to significantly reduce deforestation and preserve the ecological environment, since from one hectare of hemp crops you can obtain 4-6 times more cellulose than the annual increase in wood per hectare of forest plantings[7,31].

One of the main consumers of hemp fiber is the automotive industry. For the production of automobile panels, German and French lines for the production of non-woven fabric are used. In the construction industry, hemp fiber is used for the production of insulation and filler in low-rise housing construction, in the chemical industry - for the production of composite materials[1;15,27]. Hemp fiber (its yield is 16-25%) is long, coarse, but strong and resists rotting well during prolonged exposure to water. Upto 80% of long-fiber cellulose can be obtained from fiber, which is used as a raw material for the production of high-quality paper[2].

Research Methodology

Experiments on the selection of technical cannabis varieties were started in the Syrdarya region of the Khavast district. 5 varieties were planted in the collection nursery: Feramon, Santhica, Felin a, Fedora, Rodnik. Before sowing the seeds of industrial hemp, an agrochemical analysis of the soil was taken. The sowing date was April 12, the repetition was 4 times, the area of the registered plot was 28 m^2, with underground drip irrigation (irrigation pipes run at a depth of 20 cm, where water was supplied to the roots of plants under pressure from pumps).

During the growing season, the care of industrial hemp plants consisted of 8-10 waterings, 2 cultivations and 2 manual weeding.

Irrigation : watering every 7-10 days. After sowing, abundant watering. During the budding period and before the beginning of fruit formation, it is necessary

TABLE- 3: The amount of oil extracted from the seeds of technical *cannabis* varieties (Havos 2022).

The name of the varieties	The amount of oil in 1 kg of seeds/%	from one hectare of land	
		seed/kg	oil/kg
Ferimon 12	27	672	181
Santicha S27	23	681	156
Felina 32	26	654	170
Fedora 17	25	683	171
Rodnik	24	661	159

to fertilize plants with mineral and organic fertilizers.

Fertilizers were applied per hectare: $(NH_4)_2 SO_4$ (ammonium sulfate) – 50 kg, KCl (potassium chloride) – 50 kg and $NH_4H_2PO_4$ (ammonium) – 100 kg on an area of 0.04 ha. The specified fertilizers and doses were not unchanged. They were installed each time, taking into account the composition of the soil according to the main elements of nutrition NPK, precursor and weather conditions[8].

Observations, field and laboratory records and measurements were carried out in accordance with the "Guidelines for *cannabis* breeding and production verification of completed research works" and "Guidelines for conducting field and vegetation experiments with cannabis" VNIILK, 1980.

Research Results

The main purpose of our research was to select and create new varieties of technical *cannabis* suitable for cultivation in Uzbekistan for the production of seeds, oil and fiber, processing of agricultural raw materials and the production of competitive, export-friendly products.

Field experiments were carried out at an experimental base in the village of Khavast, Syrdarya region, located in the central part of Uzbekistan on the left side of the Syrdarya River. The experiments were carried out on the territory of an international company, the investor of which was the Industrial Innovation Group (IIG) from the UAE, who was the owner of an enterprise in the Republic of Uzbekistan.

The climate of the Syrdarya region is typically continental and arid. The Hungry Steppe occupies a significant part of the region. The amount of precipitation ranges from 130-360 mm per year on the plains to 440-620 mm in the foothills. Summers are hot, dry and clear, while winters are very cold, snowy and sometimes cloudy. Throughout the year, temperatures usually range from -4°C to 36°C and rarely fall below -11°C or above 40°C.

The hot season lasts 3.7 months, from May 22 to September 13, with maximum average daily temperatures above 30 °C. The hottest month of the year in Syrdarya is July, with an average temperature maximum of 36 °C and minimum of 21 °C. The cold season lasts 3.4 months, from November 22 to March 1, with a minimum average daily temperature below 11 °C. The coldest month of the year in Syrdarya is January, with an average temperature maximum of -3 °C and minimum of 5 °C (Chub V.E.).

The clearer part of the year in Syrdarya begins around May 17 and lasts 5.0 months, ending around October 17. The clearest month of the year in Syrdarya is August, during which the sky is on average clear, mostly clear or partly cloudy 97% of the time. The cloudier part of the year begins around October 17 and lasts 7.0 months, ending around May 17.

The cloudiest month of the year in Syrdarya is January, during which the sky is cloudy on average 59% of the time (https://ru.weatherspark.com/Sections-Temperature).

In the southeast of the region in the summer, dry winds blow for several days and dust storms rage, damaging crops. The warm period is 247 days, the annual sum of positive temperatures is 5000-5900°C. (Material from Wikipedia - the free encyclopedia).

The duration of sunshine is 2800-2900 hours per year, 90-100 hours in winter and 360-400 hours in summer months. Days "without sun" are rare. The largest number of them occur in December-January and amounts to 10-25 days in two months. From June to

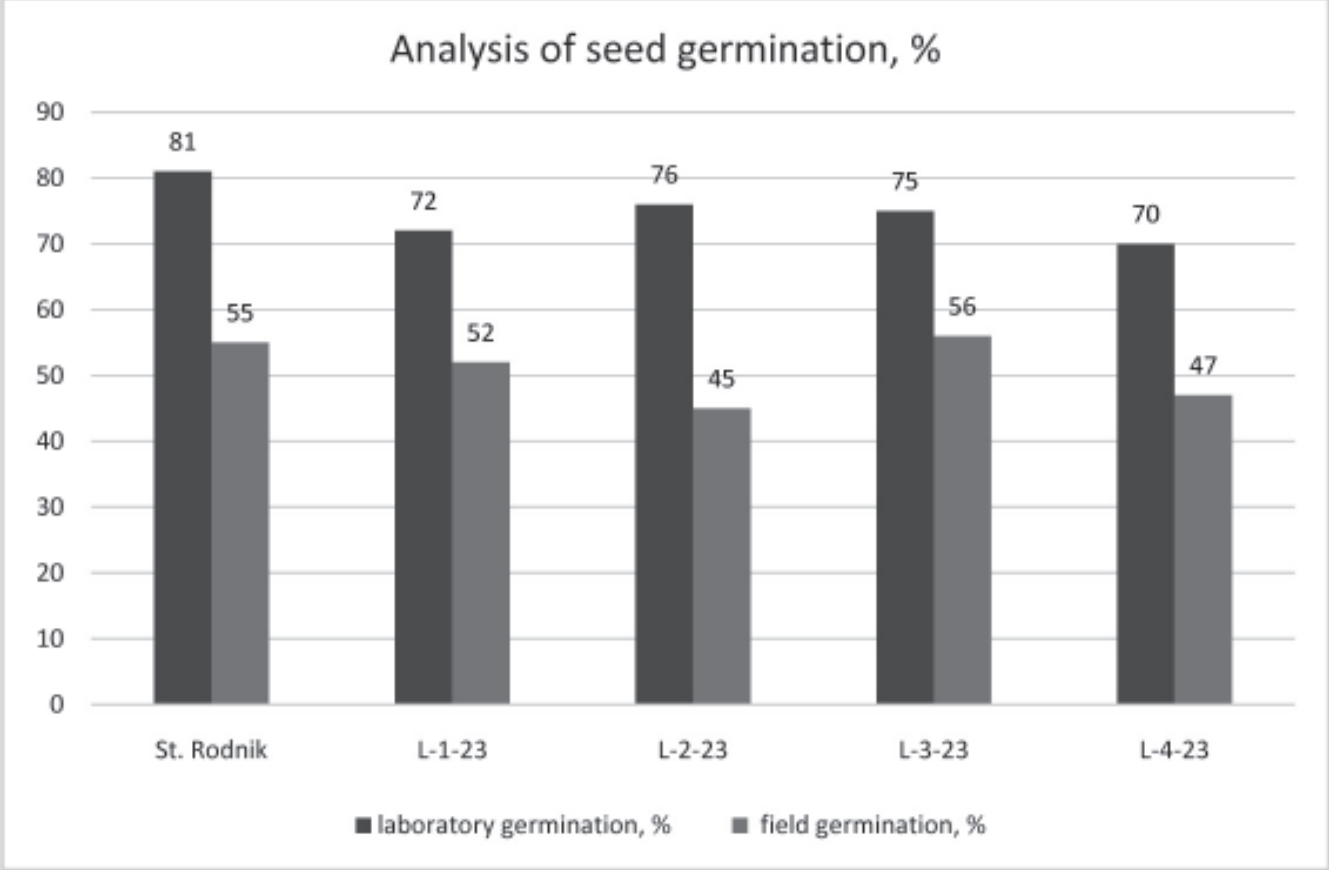


Fig. 2: Germination analysis of technical *cannabis* seeds

September there are 1 to 4 “days without sun” in 10 years. The daily duration of sunshine is 3-5 hours in winter and 12-13 hours in summer, with daylight hours of 8-9 and 15-16 hours[16].

Meteorological conditions during the period of field experiments (2022-2024) were characterized by slight deviations from long-term indicators (Fig. 1).

Soil analyses conducted at the TASHGAU educational and scientific laboratory in collaboration with the SAS AGRO MCHR laboratory showed that the soils were poorly structured with a large number of dusty particles. After watering, a fairly dense crust forms, which then cracks.

As can be seen in Table-1, the arable layer contained 0.46 - 0.67% humus, 0.1330 – 0.1535% gross nitrogen, 0.220 – 0.276% gross phosphorus and 1.75-2.20% gross potassium, and their content was slightly lower in the sub-arable horizon.We conducted experiments on the germination of seeds of four selections: Line-1-23; Line-2-23; Line-3-23; Line-4-23 in comparison with the control variety Rodnik. technical cannabis in laboratory and field conditions Table-2.

Fig.3 shows data from the analysis of seed germination in laboratory and field conditions, which show that, on average, laboratory germination ranged from 70-80%, field germination was slightly less than 45-55%. Which is generally a good indicator.

We conducted phenological observations of five varieties of technical *cannabis*: Feramon, Santhica, Felina, Fedora and Rodnik. Over the course of two years, observations were made on the appearance of mass shoots, flowering, seed tying, and technical ripeness of seeds. The phenological observations of technical *cannabis* varieties are presented in Fig. 4.

As can be seen in Table-3, the most promising varieties were Rodnik, Santhica and Felina.

As given in Fig. 4, in terms of flowering, seed setting and earlier technical ripeness of seeds, the following varieties stood out: Rodnik, Santhica and Felina at (99; 101 and 102 days from mass germination). Later seed ripening was observed in the Ferimon and Fedora varieties (102 and 104 days from mass germination).

The results of biometric measurements of industrial hemp varieties are presented in Fig. 4.

As is clear in Table-3, according to biometric measurements: (plant height, cm; number of internodes, pcs.; root length, cm; stem diameter, mm) the varieties Rodnik, Santhica and Felina stood out.

As can be seen in Table-3, biometric

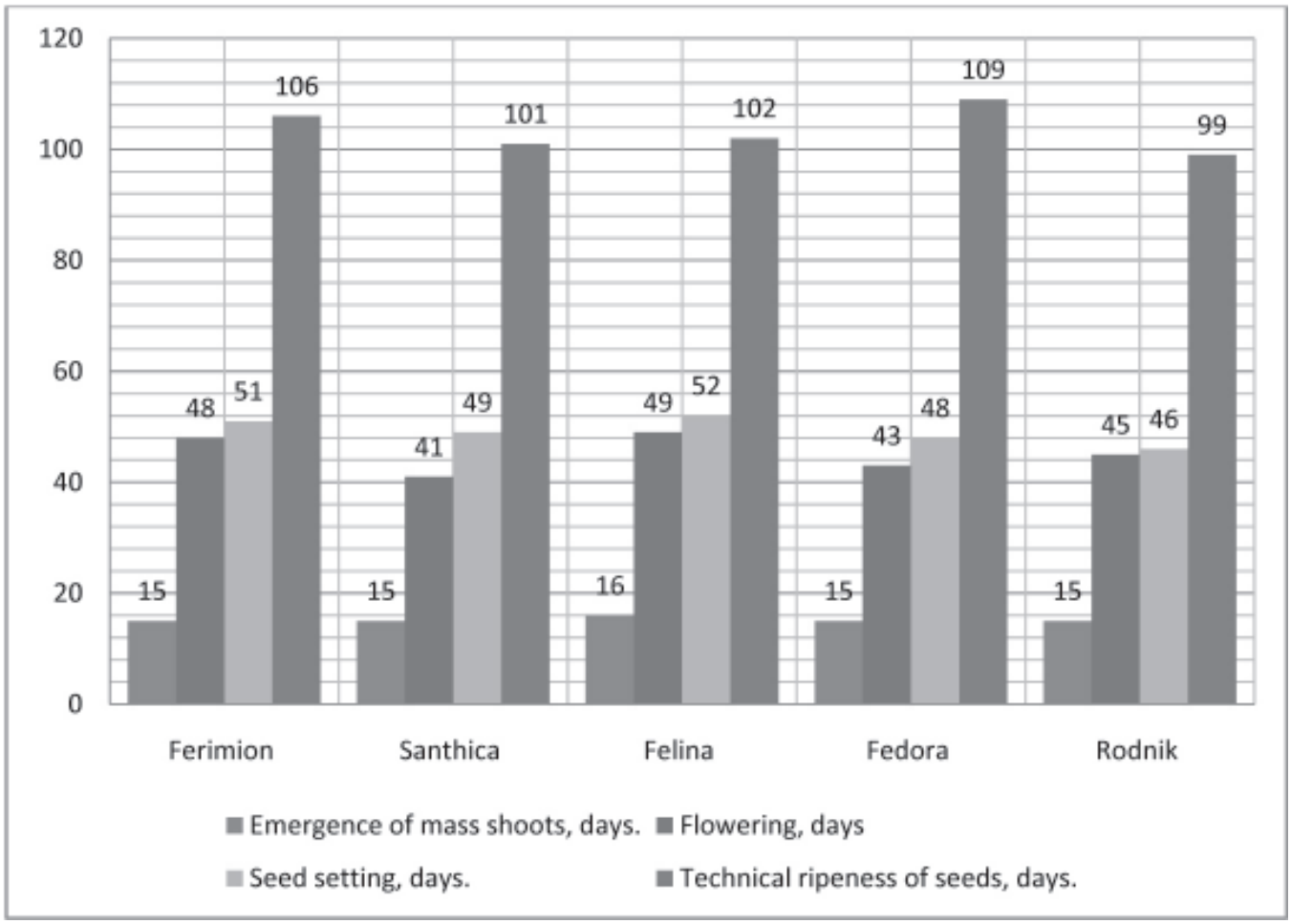


Fig.3 : Phenological observations of industrial hemp varieties for 2022-2023

measurements were carried out on the 90th day from mass shoots, which showed that the highest plant height and number of internodes were observed in the Rodnik variety - 158.6 cm and 7 pcs., and the smallest in the Ferimion variety - 92.7 cm and 6 pcs. accordingly. The remaining varieties, Santhica, Felina, Fedora, had intermediate biometric indicators.

We conducted research to determine the mass of seeds per plant, grams, and the mass of stems, grams, Table-3.

Based on modern technology, there are basically two ways to obtain vegetable oils: 1. Pressing the oil from the kernel. 2. Complete extraction of the residual oil from the oil with a solvent. Oil content (%) in the seeds of the joint venture "Industrial Innovation GROUP" Interstate Council for Standardization, Metrology and Certification GOST ISO 662 - 2019. Animal and vegetable fats and oils determination of oil content of moisture and volatile substances. According to the method, the amount of oil extracted from the seeds of the varieties was determined in the laboratory[10].

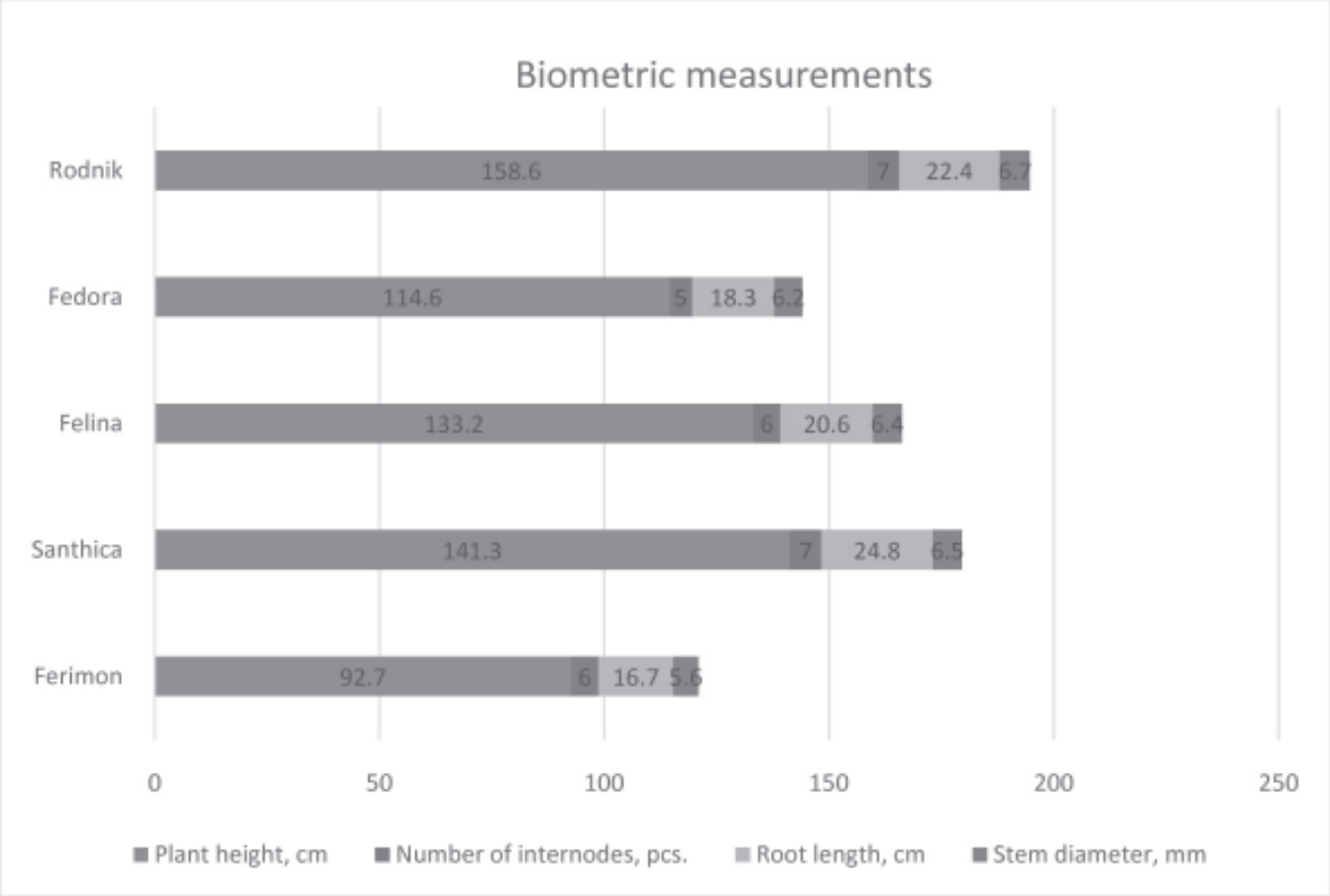
1 kg of seeds yielded 24% to 27% oil depending on the variety. The highest oil yield was 27% in the Ferimon 12 variety, the lowest oil yield was 24% in the Rodnik variety. When determining the amount of seed and oil obtained from one hectare, the Santicha S27 variety had 681 kg of seed per hectare, but because of the oil content of 23%, 156 kg of oil was formed per hectare. 181 kg of oil per hectare was obtained due to the fact that the oil content was 27%, despite the amount of 672 kg of seeds per hectare of Ferimon 12 varieties. Based on the results of laboratory and field research, it was found that growing the Ferimon 12 variety for oil from the *cannabis* varieties was more economical, and it was found that it could serve as the starting material for the varieties created for oil in the selection[10].

Conclusions

Based on our research, we can draw the following conclusions:

For the first time, research was carried out on the culture of industrial hemp in the soil and climatic conditions of the Syrdarya region, where 5 varieties were studied, which, with sufficient irrigation and compliance with cultivation technology, are quite possible to successfully cultivate.

Agrochemical analysis of the soil showed an



	Plant height, cm	Number of internodes, pcs.	Root length, cm	Stem diameter, mm
Σ	648,6	32	102,8	31,8
X	129,7	6,4	20,6	6,4

Fig.4: Biometric measurements of industrial hemp varieties for 2022-2023

increased salt content and low humus content, which must be replenished by applying mineral fertilizers during the growing season of plants.

Research was carried out on 4 selections in comparison with the standard Rodnik variety, which, with sufficient irrigation and compliance with agricultural cultivation technology, is quite possible to successfully cultivate. Breeding work was carried out using the method of individual selection of industrial hemp plants with the necessary improved characteristics for further research in order to create new local varieties for our Republic.

From 24% to 27% oil was obtained from 1 kg of seeds depending on the varieties. The highest oil yield was 27% in the Ferimon 12 variety, the lowest oil yield was 24% in the Rodnik variety. When determining the amount of seed and oil obtained from one hectare, the Santicha S27 variety had 681 kg of seed per hectare, but because of the oil content of 23%, 156 kg of oil was formed per hectare. 181 kg of oil per hectare was obtained due to the fact that the oil content was 27%, despite the amount of 672 kg of seeds per hectare of Ferimon 12 varieties. Based on the results of laboratory and field research, it was found that growing the Ferimon 12 variety for oil from the cannabis varieties is more economical, and it was found that it can serve as the starting material for the varieties created for oil in the selection.

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