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DANDELION KOK-SAGHYZ (*TARAXACUM KOK-SAGHYZ* L. RODIN) AS A ONE-YEAR CULTURE DEVELOPED UNDER CONDITIONS OF SOUTHEAST KAZAKHSTAN

Abstract. Dandelion kok-saghyz (*Taraxacum kok-saghyz* L.Rodin) is a herbaceous plant, a source of high-quality rubber. At present, *Taraxacum kok-saghyz* (Tks) is introduced into agriculture in Kazakhstan.

"Saryzhaz" is Kazakh variety of Tks tested as a one-year culture on the experimental plots of the South-Eastern Kazakhstan (N43.1471, E77.2977). The vegetation period of Tks "Saryzhaz" from the preparation of seedlings in the greenhouse (early March) until achene development maturity in the open field takes five months. The studies of kok-saghyz "Saryzhaz" as a one-year culture were repeated three times.

From the 200 m² plots, the raw root harvest was 0.35 (2017), 0.32 (2018), and 0.37 centers (2019), with a density of 10 plants per 1 m². The rubber content is 8 ± 3% per the dry weight of the root. By extrapolating the results of research to one hectare (at a plant density of 100,000), one can predict the harvest of a raw root from 16.0 to 18.5 centers per hectare.

This article demonstrates the possibility of Tks "Saryzhaz" cultivating as a one-year culture in the South-East of Kazakhstan. Tks "Saryzhaz" passes the vegetation cycle before flowering, achene development\maturity in a short spring and early summer period of 5 months.

The combination of the following conditions makes it possible to use Tks as a one-year-old culture in the South-East of Kazakhstan: the use of seedlings, sufficient moisture supply (rains, watering), increased (optimal) temperatures of the spring months for the accelerated plant development.

The increase of the root crop of Tks as a one-year-old crop can be achieved through optimization of farming practices (fertilizers, stocking density) and selection work.

Key words: Kok-saghyz, one-year culture, Kazakhstan.

Introduction. Dandelion kok-saghyz (*Taraxacum kok-saghyz* L.Rodin) is a perennial herbaceous plant, with the habitat in the valleys of the mountains of the South-Eastern Kazakhstan [1].

Taraxacum kok-saghyz (Tks) was introduced into agriculture in the last century, as a technical culture with the roots synthesizing natural rubber in the quality not inferior to the natural rubber of the tropical tree of hevea [2].

Natural Rubber (NR) is a strategically important material, used in production of a wide range of different products: tires (automobile, airplane), medical gloves and other medical products.

At present time, there is a real threat of destruction by the diseases of the largest plantations of the traditional source of rubber tree - hevea (*Hevea brasiliensis*) in the countries of South-East Asia - the main world producers of NK, and therefore a threat to the NK market.

In the light of these developments, EU [3], the US, Canada [4] (*PENRA, 2018*), and Kazakhstan are taking measures to develop research and introduction of Tks into agriculture as an alternative source of natural rubber.

In Kazakhstan, from 1932 to 1935, on the fields of the Turkestan district, South Kazakhstan, the Tks was cultivated as a one-year plant and harvest about 1 ton of roots per hectare, with the output of pure natural rubber up to 8%.

By the beginning of 1934, 5 871 hectares had been developed for sowing of natural rubber plants. But, as explained in the documents of the Archive of the Republic of Kazakhstan, "due to the financing cut in 1936, the development of industrial natural rubber production in Kazakhstan was suspended" [5].

Tks studies in Kazakhstan have been resumed since 2005 by the Institute of Plant Biology and Biotechnology (IBBR), Almaty [2].

There is a need for Tks genotypes with high root yield, high rubber concentration, and high seed vigor [6].

The purpose of this study was to test the first Kazakh variety Tks "Saryzhaz" as a one-year culture on the experimental plots of the South-East of Kazakhstan [7].

Materials and methods. Tests of Tks "Saryzhaz" were carried out in the open ground in the territory of the agricultural farm "Mirmoe": village "Ostemir": Talgar district, Almaty region, Kazakhstan (N43°37'49', E77°15'41'). The presence of artesian wells provides low-cost water supply, irrigation of farming areas "Ostemir".

The experimental plot of 200 m² combined eight small sections of 25 m² each. The soil of the site is sandy loam, with manure fertilization applied (400 kg per 200 m² plot) to a depth of 15 cm.

The seedling method of cultivation of Tks was used. In a greenhouse, seed sowing was carried out on peat pills, the seedlings developed for two months (March, April) under 25°C [8].

The planting of the Tks "Saryzhaz" seedlings was carried out in the open ground of the experimental plots "Ostimir". Density of planting is 10 plants per square meter. Care of the plantings consisted of the following measures: fertilization (manure), watering, loosening of rows, weeding.

The climate in "Ostemir" is steppe, continental with hot summers and cold winters. The spring and autumn rainy, average air temperatures in April are +18.2° C, in May + 23.9°C, that is optimal for the development of plants Tks.

The hottest months are July, August. Weather with the temperature close to +30°C is observed on average in 36 days a year (Weather in Ostemir, 2017, 2018, 2019) [9].

The collected roots were washed and dried under 80°C till the constant weight was achieved. The method of alkaline extraction of rubber from dry roots was used, followed by gravimetric determination of the rubber content by Koyalovich method [10]. The results were statistically processed [11].

Results and discussion. The life cycle of Tks "Saryzhaz" was documented across the testing period of nine months (March-November) 2017, 2018 and 2019. That is, the studies of kok-saghyz "Saryzhaz" as a one-year culture were repeated three times. The chronology and duration of various stages of Tks "Saryzhaz" growth under the conditions of the village of "Ostemir", Southeast Kazakhstan are shown in figure 1.

Growth stage	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
Preparation of seedlings. Development seedling.									
Planting seedlings. Adaptation of seedlings to the open soil. Leaf development/rosette growth.									
Inflorescence emerge									
Flowering, achene development/maturity. Peak.									
Summer resting									
Autumn flowering									
Winter resting									

Figure 1 – Chronology and duration of various stages of growth of Tks "Saryzhaz" under the conditions of "Ostemir"

In early May, seedlings with 6-8 real leaves were planted in the open ground of the experimental site (figure 2).



Figure 2 – Experimental plots "Ostemir".
Planting Tks “Saryzhaz” seedlings in April (a, b), the plots in June (c) and July (d)

The period of adapting Tks “Saryzhaz” seedlings to open soil conditions took two weeks - the leaves of the seedlings died off and then new leaves formed, a new rosette.

In early June, the beginning of flowering Tks “Saryzhaz” was marked.

The period of active flowering and achene development/maturity was mainly in July and early August. In early August, the number of leaves in the rosette reached 40-56, the length of the leaf plate 10 cm, the leaf width 1.5 cm.

The height of the aerial part with the peduncle was 22 ± 5 cm, of the total number of plants, non-flowering forms amounted to 49%, flowering forms had from 8 to 26 peduncles. Mature seeds appeared about 8-12 days later. On one peduncle there are 42-56 seeds.

The leaves of Tks “Saryzhaz” are green, in shape a leaf is entire, incised or dissected. The shares of the cut or incised leaf are wide and round, without small burrs. The leaves of the basket wrapper have carob-shaped appendages.

In August, in "Ostemir" even under the conditions of watering, the leaves dry up as Tks “Saryzhaz” has the “summer resting”, which lasts until the end of September.

With a decrease in temperature in October ($+ 16$ °C) and due to rain falls, Tks “Saryzhaz” leaves come out from the "summer resting".

New leaves grow, an outlet is formed, and then an autumn flowering is observed. After the period of "summer break" in October, the regenerated plants did not have time to recover up to the mass of the first fruiting period before "summer resting", and also 1/3 of the number of plants died.

The growth stages of the Tks “Saryzhaz” are shown in figure 3.

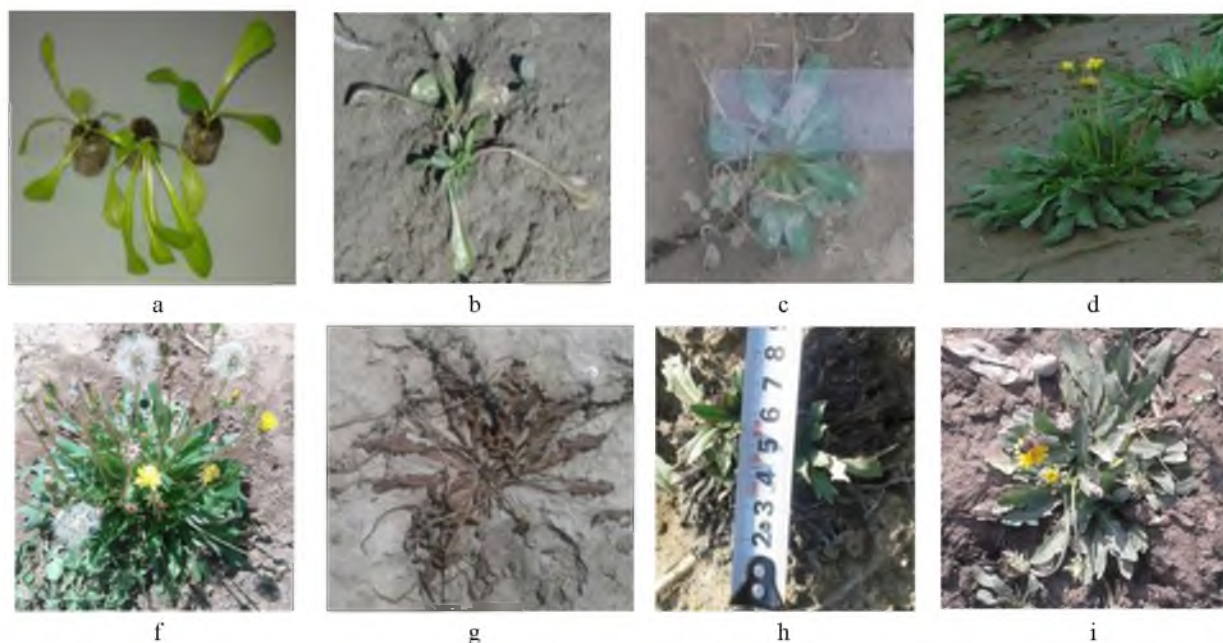


Figure 3 – Growth stages of Tks “Saryzhaz” as one-year culture. 60 -days-old seedlings (a), adaptation of seedlings to open ground (b), rosette growth (c), the beginning of flowering and maturity (d), the peak of flowering and of achene development\maturity (f), summer resting (g), plant regeneration (h), autumn flowering (i)

In the beginning of August, during the period of the fruiting Tks “Saryzhaz” root harvesting was carried out. Illustrations of the samples of the harvest of the roots and rubber of Tks "Saryzhaz" are shown in figure 4.

Tks "Saryzhaz" has a fibrous root system (which does not have the main root). The sternal root was less common (18-22% of the total number of roots).



Figure 4 – Samples of the harvest of Tks "Saryzhaz". Fibrous root types (a), raw root samples (b), dry root samples (c), and rubber samples (d)

Similar results were obtained in the last century in the South of Kazakhstan by Mynbayev K.

When manure is applied (40 tons per ha) to a small depth of up to 15 cm, about 80 percent of the total number of plants form branched roots; when applied the same amount of manure deeper up to 20-25 cm, the branching percentage drops down to 58%.

The more favorable the conditions in the surface layers of the soil, the more branched roots and the higher the yield of the root mass [12].

From the 200 m² plots, the raw root harvest were 0.35 (2017) 0.32 (2018) and 0.37 centers (2019), with a density of 10 plants per 1 m².

The average weight of one raw root of Tks "Saryzhaz" is 16 ± 5 grams, with the rubber content of 8 ± 3% per the dry weight of the root.

By extrapolating the results of research to one hectare (at a plant density of 100,000), one can predict the harvest of the raw root from 16.0 to 18.5 centers per a hectare.

Thus, this article demonstrates the possibility of Tks "Saryzhaz" cultivating as a one-year culture in the South-East of Kazakhstan. Tks "Saryzhaz" passes the vegetation cycle before flowering, achene development/maturity in a short spring and early summer period of 5 months.

The combination of the following conditions makes it possible to use Tks as a one-year-old culture in the South-East of Kazakhstan: the use of seedlings, sufficient moisture supply (rains, watering), increased, optimal temperatures of the spring months for the accelerated plant development.

The increase of the root crop Tks as a one-year-old crop can be achieved through optimization of farming practices (fertilizers, stocking density) and selection work.

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ОҢТҮСТІК-ШЫҒЫС ҚАЗАҚСТАН ЖАҒДАЙЫНДАҒЫ КӨК-САҒЫЗ (*TARAXACUM KOK-SAGHYZ* L. *RODIN*): БІРЖЫЛДЫҚ ЕКПЕ ӨСІМДІГІ РЕТІНДЕ

Аннотация. Көк-сағыз (*Taraxacum kok-saghyz* L. Rodin) шөбі – жоғары сапалы каучук көзі болатын өсімдік. Қазіргі кезде көк-сағыз Қазақстанда егістікке енгізіліп келеді.

Оңтүстік-Шығыс Қазақстан тәжірибе алқаптарында (N43.1471, E77.2977) бір жылдық екпе өсімдік ретінде бірінші қазақстандық «Сарыжаз» атты сұрыптың сынақтары өткен.

«Сарыжаз» көк-сағызының вегетациялық мерзімі жылыжайда өскіндерді дайындаудан бастап (наурыз айының басында), тұқым беруге дейін ашық жерде бес айды қамтиды. Көк-сағызды «Сарыжаз» жыл сайынғы мәдениет ретінде зерттеу үш рет қайталанды.

1 м²-де 10 өсімдік тығыздығының 200 м² алқабында дымқос тамырдан 0,35 (2017), 0,32 (2018) және 0,37 центнер (2019) алынған.

Тамырдың орташа құрғақ салмағы 8±3 % каучук мөлшеріне бір тал «Сарыжаз» көк-сағызының дымқос тамырының 16 ±5 граммына тең.

Бір гектарда (100 000 өсімдік тығыздығында) зерттеу нәтижелерін экспроприациялап, 16,0-дан 18,5 центнерге дейін дымқос тамыр өнімін бір гектардан алуды болжауға болады.

Сол себепті бұл мақала Оңтүстік-Шығыс Қазақстан аумағында «Сарыжаз» ТКС-ың бір жылдық екпе өсімдік ретінде өсіру мүмкіншілігін көрсетеді. «Сарыжаз» ТКС-ы 5 айлық көктемдегі қысқа және ерте жаздық мерзімде ғүлденуіне, жетіліп пісуіне дейін вегетациялық кезеңінен өтіп жатыр.

Келесі жағдайлардың үйлесуі ТКС-ның бір жылдық екпе өсімдік ретінде қолданылуы: көшеттерді қолдану, жеткілікті ылғалдық (жауын, суару), өсімдіктердің тез дамуы үшін көктем айларының оптималды температурасы мүмкіндік береді.

Бір жылдық ретіндегі өнімінде ТКС тамырының ұлғаюы, ауыл шаруашылық (тыңайтқыштар, отырғызу тығыздығы) пен селекциялық жұмыстар жүргізу әдістерін үйлесімділеуде жүзеге асады.

Түйін сөздер: көк-сағыз, бір жылдық екпе өсімдік, Оңтүстік-Шығыс Қазақстан.

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ОДУВАНЧИК КОК-САГЫЗ (*TARAXACUM KOK-SAGHYZ* L. RODIN) КАК ОДНОЛЕТНЯЯ КУЛЬТУРА В УСЛОВИЯХ ЮГО-ВОСТОЧНОГО КАЗАХСТАНА

Аннотация. Одуванчик кок-сағыз (*Taraxacum kok-saghyz* L.Rodin) – травянистое растение, источник каучука высокого качества. В настоящее время кок-сағыз вводится в культуру в Казахстане.

На экспериментальных участках Юго-Восточного Казахстана (N43.1471, E77.2977) были проведены испытания первого казахстанского сорта кок-сағыз «Сарыжаз» как одногодичной культуры.

Вегетационный период кок-сағыз "Сарыжаз" от подготовки рассады в оранжерее (начало марта) до плодоношения в открытом грунте занимает пять месяцев. Исследования кок-сағыз «Сарыжаз» как однолетней культуры повторялись трижды.

С участков по 200 м² получены урожаи сырого корня 0,35 (2017) 0,32 (2018) и 0,37 центнеров (2019) при плотности 10 растений на 1 м².

Средний вес одного сырого корня кок-сағыз «Сарыжаз» равен 16±5 грамм с содержанием каучука 8±3 % на сухой вес корня.

Экстраполируя результаты исследований на один гектар (при плотности растений 100 000), можно прогнозировать урожай сырого корня от 16,0 до 18,5 центнеров с одного гектара.

Таким образом, в настоящей работе продемонстрирована возможность возделывания кок-сағыз на территории Юго-Восточного Казахстана как одногодичной культуры. Кок-сағыз «Сарыжаз» проходит вегетационный цикл до цветения, плодоношения за короткий весенний и ранний летний период – 5 месяцев.

Сочетание следующих условий позволяет использовать кок-сағыз как одногодичную культуру на юге Казахстана: использование рассады, достаточное влагообеспечение (дожди, полив), повышенные (оптимальные) температуры весенних месяцев для ускоренного развития растений.

Увеличение урожая корня однолетнего кок-сағыз может быть достигнуто через оптимизацию агротехнических приемов (удобрения, плотность посадки) и селекционную работу.

Ключевые слова: кок-сағыз, однолетняя культура, Казахстан.

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