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Assessment Of Seed Germination Of Jujube (Ziziphus Jujuba Mill.) Under Field Conditions

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Abstract: This article describes the possibility of determining the germination of Ziziphus jujuba Mill., seeds, and their quality indicators. The optimal sowing depth was determined by sowing the seeds at different depths in the field. The lowest indicator was 42.6% at a sowing depth of 1-1.5 cm. The highest indicator was 81.3% at a sowing depth of 2-2.5 cm. In addition, the germination time and duration of stratified and scarified seeds were determined in the regions. The germination of stratified seeds at a depth of 3-3.5 cm germinated in 11-13 days and the highest indicator was 63.6%, while the seeds sown at a depth of 2.5-3 cm had 81.3%. The time of stratification affects the germination of stratified seeds.

Keywords: Ziziphus jujuba Mill, seed, scarification, stratification, hypotensive, salt-tolerant.

Introduction: Jujube - Ziziphus jujuba Mill., belongs to the Rhamnaceae family. It is a perennial thorny tree, 2-5 m tall. Its leaves are oblong-ovate, toothed, and arranged alternately on the stems and branches with short petioles. Its small, yellow, inconspicuous flowers are located in a semi-umbel growing from the leaf axils. The fruit is an orange-red, round or slightly oblong, sour-sweet, delicious seed. Jujube flowers in June-July, and the fruit ripens in August-September [1;189-195, 2]. It grows wild in the mountains of China, Central Asia, and the Caucasus, on dry slopes in their central part. This family includes about 50 genera and more than 500 species, mainly distributed in tropical and subtropical zones [3; 6-97-p].

In the Republic of Karakalpakstan, one species grows (Ziziphus jujuba) in Jilan jiyde and one species was introduced in the wild jilanji (Ziziphus acido jujuba). The leaves are oblong-ovate, the upper side is slightly elongated, the plate is asymmetrical, with large veins, arranged alternately on the stem and branches with a short band. The length of the leaf plate is 3.5-4 cm, width 1.5-2 cm, the edges are bluntly toothed, the upper side is hairless, shiny, the color is green, the lower side is light green, the veins are covered with hairs. The band is also hairy, the small greenish flowers are located in a semi-umbellate inflorescence growing from the leaf axils. The fruit is spherical or oblong, small (about 1.3 cm long, 1.2 cm wide), with little juice, the soft part is drier, and the taste is sweet and sour [4; 274-277-p];[5; 15-95-p];[6; 36-p].

The fruit is a reddish-brown, oblong, large, sharp-pointed, and hard seed. It makes up 25-30% of the fruit. It blooms in May-June and ripens in September-October. The flowers are stellate, greenish-yellow, fragrant, small, 0.3-0.4 cm in diameter, bisexual, and arranged in short panicles. It is an entomophilous plant [7; 43-68-p]. In Uzbekistan, the wild sedge is found in the Topolang River basin. The leaves and fruits of the sedge are used in folk medicine. The leaves are collected when the plant is in bloom and before the fruits ripen and dried in the shade [8; 259-268-p]. The fruit is harvested after it is well-ripened and dried in the open air in the sun. The leaves of the plant contain 0.36% saponins, 3.7% flavonoids (rutin, hyperoside, quercimeritrin), 6.6% sugars, 292.5 mg% vitamin C, resins, 9.46% tannins, the fruit contains up to 30% sugars, up to 25% organic acids, 3.5% flavonoids (rutin and others), vitamin C, tannins [9; 963-977-p].

The fruit of the berry has long been used in folk medicine in China, the Caucasus, and Central Asia to treat various diseases. Abu Ali ibn Sino also used the berry to treat chest pain, lung, breast, and bladder diseases, and a decoction made from the fruit is used in folk medicine as a medicine to relieve chest pain and cough, as an expectorant, to treat anemia, asthma, smallpox, diarrhea, fever, intestinal, lung, liver, kidney,

and bladder diseases, and as a painkiller, blood pressure-lowering, and diuretic. Scientific research in recent years has shown that the leaves and fruit of the berry have a hypotensive (blood pressure-lowering) and diuretic effect, and has been recommended for widespread use in scientific medicine [10].

METHODS

In general, the germination of seeds of the sedge was studied using the methods of M.K. Firsova (1959) and O.N. Granitova (1955). Plant seeds were determined according to GOST 13056.6-97 “Seeds of trees and shrubs” by species and seed quality. They were also studied using the methods recommended by T.A. Rabotnov, I.G. Serebryakov.

a b

Figure 1. *Ziziphus jujuba* seeds a) scarified b) stratified seeds.

RESULTS AND DISCUSSION

Ziziphus jujuba Mill., the seeds are oblong in shape with sharp ends, the seeds are very hard, and contain inhibitors that prevent germination. Therefore, the seeds were mainly stratified and scarified in two ways and were sown at different depths. The average weight of the seeds was 0.24 g, the length of the seed was 21.2 mm, and the diameter of the seed was 4.8 mm. The weight of 1000 seeds was 204.55 g. The germination of seeds in field conditions depends on the time and depth of their sowing. During our experiment, in order to study the effect of sowing depth on germination, seeds were sown at different soil depths: 1-1.5; 1.5-2; 2-2.5; 2.5-3 cm. The lowest seed germination rate was 42.6% at a sowing depth of 1-1.5 cm. It was found that the highest germination rate was 81.3% at a sowing depth of 2-2.5 cm. Also, at a sowing depth of 1.5-2 cm, seed germination began on the 9th-10th and 12-14th days, while at a deeper sowing depth of 2.5-3 cm, germination occurred on the 15th-16th and 11-13th days. Therefore, the germination rate may be lower as the seeds are sown shallower and deeper. It was found that when the seeds are sown on the surface of the soil, they dry out. Therefore, it is important to plant seeds according to their size and type, and to ensure optimal moisture and heat (Table 1).

Table 1

Effect of sowing depth on germination of *Ziziphus jujuba* Mill., seeds in field conditions (n=100) (2024-2025)

Years	Sowing depth (cm)	Number of seeds sown, pcs	Seed germination, days	Number of germinated seeds,% M±m	V*%
2024	1,5-2 cm	100	7-8	42,7±1,76	7,2
2024	2-2,5 cm	100	9-10	51,7±1,76	5,9
2024	2,5-3 cm	100	10-11	77,3±1,45	3,2
2024	3-3,5 cm	100	15-16	61,3±0,88	2,5
2025	1,5-2 cm	100	10-11	46,7±2,02	7,5
2025	2-2,5 cm	100	12-14	55±1,53	4,8

2025	2,5-3 cm	100	12-13	81,3±2,90	6,2
2025	3-3,5 cm	100	11-13	63,6±2,85	7,7

*V-Variation

As can be seen from Table 1, in 2024, the results of ziziphus jujuba seeds were 42.7%, 51.7%, 77.3% and 61.3% at depths of 1.5-2; 2-2.5; 2.5-3; 3-3.5, while the experiments in 2025 showed germination rates of 46.7%, 55%, 81.3% and 63.6%. The highest rates were recorded at 2.5-3 cm at 77.3% and 81.3%, and the lowest at 1.5-2 cm at 42.7% and 46.7%.

Germination of Ziziphus jujuba Mill., seeds in field conditions. During our study, seed germination was carried out by several methods, namely stratification and scarification.

Table 2

Field germination of stratified and scarified seeds of *Ziziphus jujuba* Mill. (n=100) (2024-2025)

Experiment options		Sowing time 31.03.2024		End of germination % M±m	V*%	Sowing time 02.04.2025		End of germination % M±m	V*%
		Germination				Germination			
		output	ending			output	ending		
Nukus district	stratified	28.04	24.05	40,7±1,45	6,2	30.04	27.05	45,3±2,03	7,75
	scarified	19.04	18.05	42,3±4,05	16,6	26.04	22.05	46,7±3,93	14,59
Amudarya district	stratified	25.04	21.05	53,7±3,18	10,3	21.04	19.05	52±4,04	13,46
	scarified	10.04	04.05	65,3±3,18	8,4	13.04	10.05	68,3±3,48	8,82
Nukus city	stratified	20.04	12.05	48,0±4,05	14,6	23.04	20.05	44,7±2,91	11,27
	scarified	09.04	30.04	49,7±4,34	15,1	17.04	12.05	53,3±3,76	12,20

*V-Variation

In our scientific research, the first seeds were sown on March 31, 2024. The air temperature in March 2024 was 19.2 mm, the average precipitation was 10.2 0 C, and the soil temperature was 10.2 0 C. In the Nukus district, the initial germination of stratified seeds was 28 days, and scarified seeds germinated in 19 days. In the Amudarya district, germination was observed in the first 25 and 10 days, while in the city of Nukus, seeds began to germinate somewhat faster, on the 20th and 9th days. In the city of Nukus, when seed germination was stratified, the duration of germination on the 20th day was 22 days, and during scarification, it was observed on the 9th day, and seed germination lasted 21 days. So, when we examined the stratified seeds, the highest indicator was 53.7% in the Amudarya district, while the lowest indicator was 40.7% in the Nukus district. It is also necessary to take into account the air temperature and the physicochemical properties of the soil. Because the level of seed germination depends not only on the seed itself, but also on external environmental factors. Air temperature enhances or reduces seed germination. The soil's water-holding capacity and pH level have a significant impact on seed germination.

In the second year of our scientific research, the seeds of the chilanjida were sown in the experimental fields on April 2, 2025. The air temperature in April 2025 was 15.2 mm, the average precipitation was 13 0 C, and the soil temperature was 13 0 C. The shortest period of seed germination was in the Amu Darya district, where the scarification option was 11 days. In the Nukus district, stratified seeds were observed for the longest time, 28 days. The highest germination rates were recorded for scarification, 68.3%, and stratification, 44.7% (Table 2).

CONCLUSIONS

According to the results of our experiments, the highest seed germination of Ziziphus jujuba Mill., was observed in the 2.5-3 cm soil layer, where the seed germination was 81.3%. There are significant differences in germination of stratified and scarified seeds sown in spring. Jujube is a perennial tree plant that reproduces mainly by seeds, in some cases it can be propagated by cuttings. The germination of stratified seeds when planted to a depth of 3-3.5 cm germinated in 11-13 days and the highest indicator was 63.6%, while seeds planted to a depth of 2.5-3 cm from scarified seeds had 81.3%. The stratification time also had an effect on the germination of stratified seeds. In this case, seeds stratified for 70 days germinated in 20 days, while seeds stratified for 50 days germinated in 28 days. According to the results obtained, when sowing seeds

of Ziziphus jujuba Mill., in the Republic of Karakalpakstan in field conditions, stratified or scarified seeds are sown in March-April, when the air temperature is 12-15 0 C and the soil temperature is 13 0 C, stratified seeds are sown to a depth of 3-3.5 cm and scarified seeds are sown to a depth of 2.5-3 cm, and on average, 77.3-81.3% germination is achieved.

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