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Seed yield and chemical properties of two exotic cultivars of soybean introduced in the Surkhandarya region of Uzbekistan

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Abstract

In Uzbekistan, interest in growing soybeans has increased in the recent years. Since the seed production industry here is rather small with heavy dependence on imports, there is a constant need to introduce potentially productive exotic introductions and to test them for identification of optimal combinations of agro-techniques enabling high yield and seed processing quality. The objective of this exploratory and initial in a continued series of trials was to investigate early trends in cultivar adaptation for economically important traits expressed in a large potential cultivation area located in the southernmost region of Uzbekistan, marked with relatively dry and hot climate. Effects of early and mid-season sowing regimes on the seed protein and oil content and grain yield of two new Russian varieties were determined, which were tested along with three well adapted local cultivars..

With late sowing dates, the protein content tended to be somewhat higher, while with early sowing regime, the oil yield tended to be on the higher side. Results of the field trial comprising five planting windows between March 20th and Aril 30th at 10-day intervals showed that all five varieties performed best for yield and seed processing quality when sown on or around April 10th. The two exotic selections did not have any major agronomic advantage over the local selections. The cultivars Chara and Slavia known to be high yield performers elsewhere within Uzbekistan, however, showed higher protein content under early sown conditions. Further research is being continued to determine over years the most optimum combinations of agro climatic and agronomic practices to realize greater yield and exploit economically important traits of cultivars.

Keywords: soybean introductions; cultivar adaptation; sowing and harvest time; grain quality; oil and protein content.

INTRODUCTION

Soybean is an important protein and oil rich legume, whose production in the recent years has shown a sharply increasing trend. The interest of producers and farmers in growing this crop has increased, as evidenced by the annual increase in soybean sown areas from 100 hectares to 300 thousand hectares. Currently, soybean is sown as the main, as well as a secondary crop after winter wheat in the Surkhandarya region located in the extreme southeast of the country bordering Tajikistan and Afghanistan. Since the frost-free period in this region extends between March and end November, the crop can be grown as main (winter) crop sown in March and April, and late (summer) crop sown in May and June. There is also a prevailing practice of growing a ratoon “stubble” crop following the main crop. Seeds of several

high yielding cultivars are regularly introduced from other countries, which are then subjected to adaptation trials for possible comparative advantage, withstanding the typical hot and dry climate during crop season prevalent here.

In an area dominated by cotton and cereals, soybean seed industry here is yet new and small. However, since 2017, following the adoption of new laws permitting large scale introduction and cultivation of exotic soybean cultivars and the commissioning of several new soy processing enterprises, the demand for new and productive entries has steadily increased. The range of productivity of such newly introduced varieties within each region and each district needs to be determined in each unique agro climatic zone with peculiar growing conditions typical of locations differing sharply in climatic parameters, for realizing full expression of economically important traits chiefly by manipulating optimal sowing season and time.

It is relevant to point out that the range of climate and soil fertility conditions prevailing in the southernmost "Surkahndarya" region of Uzbekistan differ sharply from other cultivation regions elsewhere within the country. Spring comes here early, often starting in early of middle of March, and for best performance, soybeans are to be promptly sown within the shortest possible time until first week of May for the best realization of yield. Thus, the typical growing season of the soybean varieties here lasts between 90 and 110 days. Due to scant and erratic rainfall during the growing season, soybean varieties are grown here under irrigated conditions.

A detailed review of soybean growing scenario currently prevailing in Uzbekistan appears in some related studies determining the role of major and micronutrients and plant growth stimulators (Kamalova et al., 2021). Following global climatic change, since eco-climatic conditions can often be unpredictable within each cropping season, there is a general agreement among soybean agronomists that sowing date remains a singularly important determinant of yielding ability. Considering the success of these 2 new introductions cultivars reported elsewhere and also of the other popular soyabean varieties grown here in Surkhandarya, we selected an optimum range of five planting windows with sowing time between March and end April, for the present study.

In one recent study conducted in two extremely distant soybean cultivating Russian regions, viz., Primary region of the far east and the contrasting cold and temperate Southwestern locations of Krasnodar (Novikova et al., 2020), higher crop productivity has been generally observed under the relatively colder climatic conditions, as against that in the other region. In another recent study by Kamalova et al. (2021), the cultivars Slavia and Chara have been identified as capable of high productivity in the northeastern locations of Uzbekistan.

Materials and Methods

Two high yielding varieties from Krasnodar region of Russia, viz. "Slavia" and "Chara" and three local varieties "Madaniyat B", "Madad" and "Orzu" (superior in yield and agronomic attributes), were included in this study conducted during the crop season of 2020. To identify the expression of agronomic and seed processing characteristics of the five varieties, a large, replicated field experiment was carried out at the Institute Experimental Farm, characterized by fertile meadows with *Sierozem* soils typical of Denov district of the Surkhandarya region, with humus content of 0.9-1.1%, mobile phosphorus 22.3 mg / kg, nitrogen 17.4%, and potassium 245.0 mg/kg. Two sowing regimes, viz. early season (spring) and mid-season (summer) were envisaged in the field trial laid out with a total of five planting windows laid at ten-day intervals, between the period of 20th March and 30th April.

Results and Discussion

A broad comparison of averages over two contrasting sowing regimes, viz., early - 1st April (spring) and mid-season - 15th May (summer), revealed that the overall chemical composition of soybean seeds expressed rather limited variability (Table 1). Data in Table 1 also suggested that the average oil content for all varieties under early sowing regime is lower by 2-3% compared to summer sowing.

Table_1: Performance under two sows regimes for seed oil and protein content.

Varieties	Oil content, %		Oil yield kg/ha		Protein content, %		Protein yield kg/ha	
	Spring sowing	Summer sowing	Spring sowing	Summer sowing	Spring sowing	Summer sowing	Spring sowing	Summer sowing
Early season planted (Before April 10th)								
Slavia	18	19	275	251	39	42	566	550
Chara	16	17	289	244	36	39	663	631
Average	17	18.5	282	247.5	37.5	40.5	614.5	580.5

Mid-Season planted (After April 10th)								
Madad	20	22	396	362	40	42	689	675
Madaniyat B	19	21	399	381	36	39	756	744
Orzu	20	22	400	381	37	39	740	705
Average	20	21	400	374	38	40	740	712

In general, among the two Russian varieties, seeds of Slavia contained more oil, but the grain yield was two times lower, as compared to domestic varieties.

Table_2: Influence of sowing dates on the number of beans and the yield of soybean varieties

Variety	Traits	Sowing Dates				
		20 March	1 April	10 April	20 Apr	30 Apr
Madaniyat B	Number of beans	54.3	56.7	57.8	58.5	51.5
Slavia	Number of beans	31.2	34.1	38.5	36.6	35.5
Chara	Number of beans	30.1	32.6	34.7	33.2	32.4
Madad	Number of beans	44.7	46.4	47.5	42.3	44.0
Orzu	Number of beans	44.6	46.7	48.7	43.2	37.9

Table_3: Influence of sowing dates on the yield of soybean varieties Q/ha

Sowing dates	Madaniyat B	Slavia	Chara	Madad	Orzu
20.03.2021	27.8	22.1	23.8	26.9	24.7
1.04.2021	34.7	24.6	25.7	32.7	32.0
10.04.2021	31.8	24.2	24.8	32.3	33.4
20.04.2021	31.9	22.7	23.6	28.5	27.6
30.04.2021	30.2	21.0	23.0	26.3	26.8
Average	31.48	22.92	24.18	29.34	28.90

It can be seen from the above tables that Madaniyat B remained the most productive, the average yield of the variety in terms of terms being 31.48 q/ha. The yields of Madad and Orzu turned out to be close to each other, being 29.34 and 28.90 q/ha. Slavia turned out to be the lowest yielding, with 22.92 q/ha of grain yield.

As can be seed from the from the data in Table 2, the two groups of varieties of the Krasnodar and Uzbek breeding origin showed clear differences as expected, in terms of morphological and productivity indicators. With early sowing, the soil not being warm enough while low temperatures are observed, plant growth traits in the exotic cultivars such as height and number of pods, were presumably negatively affected in the exotic group of cultivars.

Conclusion

As a result of the initial exploratory field trial, we concur with the inference that the Predominant factor of soybean agro technology in specific soil and climatic conditions of the southern regions of Uzbekistan seems to be sowing time. Of all cultivation practices, the most significant influence on the development of soybean varieties is known to be exerted by optimal sowing dates, as also according to some related studies (Baranov and Baranova, 2011).

Generally, along with the timing of sowing, several other morpho-physiological factors are known to affect the assimilation processes determining seed chemical composition (Yormatova et al., 2022). In our subsequent studies, the effects of field temperatures considering important morphological and productivity traits will be analyzed, with the intent of continued efforts directed towards identifying and optimizing specific productivity norms of the new introductions. Since cultivar adaptation is a lengthy process, we intend also to continue large scale testing, while recording and analyzing long-term performance for specific traits of economic interest.

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