R. N. Nazaryan[1*],G. S.Khachatryan[2],G. A.Tovmasyan[3],M. A. Hokhanyan[4]

The harvest productivity of winter wheat depending on sowings dates and predecessor in Sisian subregion conditions of Zangezour agricultural area, RoA

Affilations
[1] Associate professor at chair Crop production and soil science of ANAU
[2] The head of ANAU Sisian brunch, PhD
[3] Associate professor at chair Crop production and soil science of ANAU
[4] Post-graduate student at chair Crop production and soil science of ANAU

Correspondence
Rudik Nazaryan: rudiknazaryan@yahoo.com

Abstract

Our studies were related to influence of both early and relatively late sowing varieties on the productivity of biologically different Russian origin varieties Nota, Tanya, Batko, and Krasnodar 99 winter wheat varieties. Productivity assessment was conducted on the background after two pre-crops - perennial feed crops and pure fallow. Sowing was carried out from August 20 to September 30 of 2020-2022 with an interval of 10 days. The marked decades are grouped into 4 sowing periods: early, middle, late and very late. The Tanya variety provided the highest yield at the middle sowing time (September 1-10 and September 10-20), and this pattern was recorded during the 3 years of the study both when sowing after perennial feed crops and pure fallow. The variety Krasnodar 99 shows a more flexible character to sowing dates. The yield of this variety was at almost the same level with middle, late, and very late sowing dates, and with both pre-crops, it was 30-35 c/ha. Low yield (27.5-30.2 c/ha) was recorded when sowing in the early stages.

The Batko variety is more responsive to delays in sowing. It can be considered as a variety that grows poorly in the autumn and lags in subsequent development. This variety can be sown no later than 1st of September. The highest yield of the Nota variety was obtained with an average sowing period and the pre-crops perennial feed crops amounted to 30.5 c/ha, and after pure fallow 33.8 c/ha of grain was provided.

Keywords

Winter wheat, Variety, Sowing time, Pre-crop, Yield.

Introduction

In Armenia, the most common form of wheat is winter wheat, and it is cultivated in all agricultural zones. Based on the data of the national food balance in the period 2022-2023, the level of self-sufficiency in wheat ranged from 34-41% (on average 36%). Only 650-720 thousand tons of wheat are used annually in the Republic of Armenia, and the volume of local production is 180-200 thousand tons, which is a considered as a very low volume.

Analysis of yield data indicates that not only is the potential productivity of zoned varieties not being realized, but also that work on variety renewal has not been carried out for a long time. Experiments conducted by numerous researchers indicate that sowing time is important factor for all winter crops, as well as for winter wheat. It is known that the growth and development of winter wheat sown at different

sowing dates are determined by the influence of various factors. The sowing times of winter wheat is essentially determined by weather conditions, i.e. the amount of light and temperature before going into winter, the moisture content and nutrients in the soil. These factors have a significant impact on the growth and development of winter wheat. (Barshadskaya S. I. 2016).

Untimely sowing, first of all, affects the endurance of crops in unfavorable overwintering conditions. The processes of accumulation of sugars in plants and hardening of winter wheat depend on the sowing time, which in turn determines their winter and frost resistance (Gubanov Ya. V., Ivanov N. N., 1988; Belyakov I. I., 1990).

A number of authors note that when cultivating winter wheat, sowing should be carried out within the effective timeframes proposed by research institutions in the region. According to this Kuban institute, the effective sowing period is very limited and does not exceed 15 days. V.A. Gumidova (1989) writes that with extensive cultivation technology, winter wheat is sown from September 1 to 5, with intensive technology - from August 25 to September 3. Deviation from the marked period by 10 days leads to a decrease the yield by 2-3 c/ha, and sowing carried out in the first days ensures maximum yield (Prutskov F. M., Osipov I. P., 1976).

Even though winter wheat is the most cold-resistant among winter crops, in some years, thinning of plant cover may be observed. For sub-mountain and mountain zones with more severe winter and early spring conditions, cold – winter resistant varieties are needed to properly apply agricultural technology for cultivating new and regionalized varieties.

Material and methods

Our studies examined the influence of both early and relatively late sowing varieties on the productivity of biologically different winter wheat varieties. Winter wheat of Russian origin varieties Nota, Tanya, Batko, and Krasnodar 99 were studied. Productivity assessment was conducted on the background of the commonly used mineral fertilizer P120K120 and nutrition N120 after two pre-crops - perennial feed crops and pure fallow. Sowing was carried out from August 20 to September 30 of 2020-2022 with an interval of 10 days. The marked decades are grouped into 4 sowing periods: early, middle, late and very late.

The research was carried out at the experimental station of the Syunik Union of Seed Producers (USP). Experiments were carried out under non-irrigated conditions in triplicate replications with a plot of 100 m^2. Harvesting was carried out manually.

Results and discussions

The average yield data of the studied varieties are shown in Table 1.

The Tanya variety provided the highest yield at the middle sowing time (September 1-10 and September 10-20), and this pattern was recorded during the 3 years of the study both when sowing after perennial feed crops and pure fallow. In the first case, when sowing was on August1-10 the yield was recorded 34.5 c/ha, in case of sowing on September 10 to 20 the yield was recorded 35.4 c/ha. In the same time sowing of the after pure fallow variants, the yield level was recorded 36.8 and 36.6 c/ha respectively.

In the third ten days of September, the yield of this variety decreased by 7.5 c/ha. For all varieties, relatively low yields were recorded when

sowing in the early stages (August 20-30) after perennial feed crops were as pre-crops.

The variety Krasnodar 99 shows a more flexible character to sowing dates. The yield of this variety was at almost the same level with middle, late, and very late sowing dates, and with both pre-crops, it was 30-35 c/ha. Low yield (27.5-30.2 c/ha) was recorded when sowing in the early stages.

The results of three years of research confirm the advantage of the Krasnodar 99 variety over other varieties when sowing late in the pre-crop pure fallow, and when sowing after perennial feed crops, its yield was 29.9 and 30.1 c/ha.

Such responsiveness of this variety allows it to be included in the group of fast-growing varieties that manage to develop well even at late sowing dates.

The Batko variety is more responsive to delays in sowing. It can be considered as a variety that grows poorly in the autumn and lags in subsequent development. This variety can be sown no later than 1st of September.

The variety Nota also belongs to the group of varieties that have a slow rate of autumn growth. Three years of research have shown that the yield of this variety drops sharply at very late sowing dates. The highest yield of the Nota variety was obtained with an average sowing period and the pre-crops perennial feed crops amounted to 30.5 c/ha, and after pure fallow 33.8 c/ha of grain was provided. At a very late date, the yield decreased by 6.4 and 6.0 c/ha respectively.

It should be noted that weather conditions also have a certain influence on the realization of the genetic potential of the tested varieties. In 2021, the most favourable temperature and humidity conditions were noted, contributing to the formation of the highest yield of the studied varieties. The minimum yield in our experiments, regardless of the variety, pre-crops, and sowing date, was obtained in the relatively favourable year of 2022.

Considering the influence of sowing dates on individual indicators of crop formation, it should be noted that the same pattern was not recorded for all varieties.

Analysis of the dependence of grain yield of the tested varieties of winter wheat on the density of productive stems showed that the highest values of this indicator ensure the highest yield.

For the Tanya variety, the best density of productive stems is considered to be 580-620 pcs/m^2. Exceeding this density in crops leads to a decrease in yield.

In the varieties Batko and Krasnodar 99, the yield increases in parallel with the increase in spiked stems.

Over the years of research, the largest number of plants per unit area was observed in 2020-2021. In those same years, the greatest density of productive stems per 1 m^2 was noted, and when sowing was delayed, the height of the plants decreased. The plant height of almost all varieties ranged from 90-100 cm and no significant difference was noted, depending on the pre-crops.

As a result of the analysis of the yield of the studied varieties and the average data of three years of research, a correlation was revealed between the yield and the density of plant standing, which was observed when cultivating the varieties Nota and Tanya after perennial feed crops. In the case where the pre-crop was pure fallow, the yield mainly depended on the number of productive stems per unit area.

Table 1. The yield of winter wheat varieties depends on the sowing time and pre-crops /average 2020-2022/

Variety name	Sowing time, Day/month	Pre-crop							
		Perennial feed crops				Pure fallow			
		Grain yield, c/ha	Number of productive stems, pcs/m²	Plant height, cm	Density of resistant plants, pcs/m²	Grain yield, c/ha	Number of productive stems, pcs/m²	Plant height, cm	Density of resistant plants, pcs/m²
Nota	20 - 30.08	38,2	476	93,7	329	31,9	495	96,1	398
	01 - 10.09	30,5	514	94,0	397	33,8	493	96,3	394
	10 - 20.09	30,1	509	93,0	409	32,4	451	92,7	396
	20 - 30.09	24,1	570	89,0	429	27,8	516	89,3	409
Tanya	20 - 30.08	28,8	601	91,0	365	30,7	542	91,5	403
	01 - 10.09	34,5	621	90,3	404	36,8	552	92,7	401
	10 - 20.09	35,4	621	93,3	457	36,6	533	91,0	409
	20 - 30.09	27,0	606	92,7	487	29,4	596	92,7	467
Batko	20 - 30.08	26,1	567	83,5	313	27,4	521	83,4	399
	01 - 10.09	28,4	598	90,0	419	30,4	590	86,5	430
	10 - 20.09	28,2	550	90,5	432	30,7	558	84,5	377
	20 - 30.09	22,3	530	86,0	389	26,1	540	84,0	417
Krasnodar 99	20 - 30.08	27,5	553	94,7	338	30,2	493	97,7	357
	01 - 10.09	31,4	587	99,9	410	33,0	532	98,5	433
	10 - 20.09	33,6	598	99,5	435	35,5	530	101,1	447
	20 - 30.09	30,1	536	98,1	393	29,9	452	95,7	398

Conclusions

For each variety, you should choose the correct sowing time, taking into account the biological form of development of the variety and the rate of autumn growth. The varieties Tanya and Krasnodar 99 are characterized by the highest rates of initial growth. Among varieties with slow autumn growth include the Nota and Batko varieties. The maximum yield of these varieties is ensured at middle sowing dates (September 1 to 10). Although the Batko variety is inferior to the Tanya variety, it is suitable for early winter sowing. This variety is characterized by a low rate of autumn growth and should be sown, if possible, early from September 1, after perennial feed crops and in the case where the pre-crop is pure fallow, sowing is carried out from September 10-20.

Conflicts of interest

The authors declare that they do not have any conflicts of interest.

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