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Influence of the wheat seeding dates on the biometric indicators in the climatic condition of Samtskhe-Javakheti

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A B S T R A C T

The impact of climate change on the entire plant development chain has not been fully assessed so far; however, some aspects of this process have been affected by climate change and adaptation measures have been prepared [1]. Due to the impact of climate change (early frosts, weak plant growth), it is important to determine the optimal timing of wheat sowing in the Samtskhe-Javakheti region. For this purpose, surveys were conducted in 2018-2019. According to the results of our studies in the region of Samtskhe-Javakheti, the timing of wheat sowing has changed as a result of climate change. The previous sowing dates were moved forward by around two weeks. According to our data, the optimal sowing period is from October 1 to October 15. Wheat sown during this period precedes normal development in autumn. It overwinters easily, can withstand frosts in spring and blooms well. The plant grows strongly and yields a high–quality crop.

Keywords: Wheat, Variety, Seeding terms, Frost-resistant, Drought, Biometric indicator.

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Introduction

Interaction of a human and a climate is the major problem at this stage of mankind's development and it can become the reason either for progress or regress of the society. It is noticeable especially in the highland countries, like Georgia.

Samtskhe-Javakheti is one of the most important regions distinguished due to the above-mentioned problem in Georgia located in the south-west of the country and having different climatic conditions compared to other regions of Georgia. It can be explained by the influence of location. There are a series of differences including temperature, climate conditions in Samtskhe-Javakheti, mainly related to geographical location and complicated landscape, radiation regime, dominant atmosphere general and local circulation conditions. According to the meteorological observations, we can conclude that a dramatic change in average temperature takes place in Samtskhe-Javakheti, the cases of warming and cooling were registered [2].

Climatic conditions are diversified in Samtskhe-Javakheti. It is characterized by moderate precipitation, dramatically expressed seasonal changes in climate parameters and a high level of solar radiation. Samtskhe and Javakheti differ from each other very much. Samtskhe is characterized by a moderately dry, sub-tropic mountainous climate with a little snowy winter and long, cool summer [3].

Winter wheat is the main cereal crop in the Samtskhe-Javakheti region. Wheat is grown mainly in non-irrigated land and the drought of autumn and spring affects it mostly. The negative impact of the drought is evident after seeding, during spring, and after seed enlargement. Therefore, agricultural terms have crucial importance during in growing technology of winter wheat. Plant growth and development depend on agrometeorological conditions, resistance to the high and low temperature, diseases, and pests, finally influencing the yield and biometric indicators of wheat. The winter without snow often is the problem for winterization of the winter wheat. In case a

plant has 4-6 leaves with completed growth and it is quite bushy, it can winterize well, it is supported by the proper amount of nutritional elements . In case the plants are planted during a non-optimal period and are overgrown, it will not be resistant towards the long-term frosts in winter; it will cause loss of yield. Late seeding also influences the yield rate and biometric indicators of the plant, as the latter is not able to develop properly and meets winter weakly developed [4].

One of the key weaknesses of Agriculture in the Samtskhe-Javakheti region is a limiting factor of agro-climatic resources. In particular, short-vegetation period, therefore, selection of winter and frost-resistant varieties for the season, defining the optimal terms for seeding to support overwintering of the crop and guaranteed yield [5].

Methodology and materials

The goal of the research was to define seeding terms and their influence on the plant biometric data and harvesting rate.

In order to define the optimal sowing dates the seeding took place for four terms in 2018 and 2019:

The first term - Seeding 20/09, seeding norms 4 millions seeds capable to grow per 1ha;

The second term - 01/10, seeding norms 4 millions seeds capable to grow per 1ha;

The third term - 10/10, seeding norms 4 millions seeds capable to grow per 1ha;

The fourth term - 20/10, seeding norms 4 millions seeds capable to grow per 1ha.

During the vegetation period, the phenological observations took place using the UPOV (The International Union for the Protection of New Varieties of Plants) method. After harvesting the sample plants were taken from each norm and their biometric indicators were studied.

For defining an optimal period of sowing, the factors studied are the duration of the phenological phases and general vegetation period, the viability of wheat varieties in each term of seeding (germination of the seed, survival of the germinated plant, (winterization capacity), the offshooting rate of the plants, the height of the plant, resistance to the diseases, the length of the spike, the number of fertile and sterile spikes, the number and the weight of the seed in spike, the weight of one plant and 1000 seed, the number of productive tillers per plant , the weight of the seed per the unit.

The total yield per ha for each sample of the trial was measured. The sample from each variety, the so-called square, was taken for defining productivity. One square was taken from each part, which was marked after the completion of the germination phase. The number of the plants and the number of the productive tillers and productivity of the seed (in gr) were defined per each square on the unit (1m2).

The following three varieties of the wheat were used in each planting term Akhaltsikhis tsiteli dolis puri (Triticum aestivum var. ferrugineum), Tbilisi 15 and Sauli 9. Seeding was repeated 3 times. The planting took place in one day during each term of planting. The observation area for each sample of planting was 25m2. The quantitative data received were processes by the arithmetical statistical method [6].

Results and Analysis

In 2018-2019 the research was conducted based on the above-described methodology. During the entire vegetation period, plant development was observed according to the pheno-phases and seeding terms. The total data received during the research are summarized in **table 1**.

According to the data analysis, the second and the third terms (from October 1 to October 15) are the most effective and optimal period for seeding wheat in the climatic condition of Akhaltsikhe, as the plant can develop several leaves (4-6) and winterize properly. The length of the spike is higher in the second and third terms, as well as the seed number and consequently, the weight of the seed is more in the second and the third terms. In the case of early seeding, the plant is developed better, the plant height is more and in most cases, it causes plant lodging and therefore it is not resistant to the long winter frost.

As the observation shows, the early frost cases are very often in the Samtskhe-Javakheti region and it causes loss of wheat yield. In case of late seeding the plant is not able to grow properly and is unable to overcome the winter frost, the number and weight of the seeds in the spike are reducing and affects productivity of the crop. A significant deviation in either direction (too early or too late) has a negative impact on the crop. This is why the selection of the relevant seeding period is crucial for seed quality and productivity considering the region’s climate specification.

Conclusion

The results of the data analysis demonstrated the influence of each version on the intensity of the plant

Table 1. *Influence of the winter wheat seeding terms on biometric characteristics of the plant (2018-2019)*

The key findings of the research are given in the form of graphics (Fig. 1-4).

Variety	Seeding norm, mln /ha	Number o plants (main characteristics), per 1m²								
		Plant height, cm	breeding		Length of spike, cm	amount of wheat head		The number of seed in the spike, each	One seed, weight, gt	The length of seeds in the spike, gr
			Productive	Non-productive		Developed	Non-developed			
Akhaltsikhe Red Dolly, I term	4	144.0	8.0	0.5	8.5	16.0	1.0	30.0	1.33	39.9
Akhaltsikhe Red Dolly, II term	4	140.0	8.5	0.5	9.2	18.0	0.5	35.0	1.33	46.55
Akhaltsikhe Red Dolly,III term	4	135.0	9.5	-	9.0	18.0	1.0	34.0	1.35	45.9
Akhaltsikhe Red Dolly, IV term	4	140.0	8.5	1.5	8.2	14.0	1.0	26.0	1.30	33.8
Tbilisi 15, I term	4	95.3	7.0	0.5	10.0	14.5	1.2	27.0	1.13	30.51
Tbilisi 15, II term	4	94.0	6.2	-	11.0	15.5	0.2	31.1	1.15	35.8
Tbilisi 15, III term	4	92.3	6.0	0.2	11.5	15.0	1.0	28.0	1.16	32.48
Tbilisi 15, IV term	4	90.0	5.0	0.2	11,0	14.0	1.2	27.0	1.13	30.51
Sauli 9, I term	4	100.0	8.0	0.5	11.0	22.0	2.0	40.0	2.05	82.0
Sauli 9, II term	4	95.0	6.0	0.3	13.0	24.0	1.0	46.0	2.25	103.5
Sauli 9, III term	4	90.0	7.0	0.1	12.0	22.0	-	45.0	2.20	99.0
Sauli 9, IV term	4	85.0	6.0	0.6	9.0	18.0	2.0	32.0	2.10	67.2

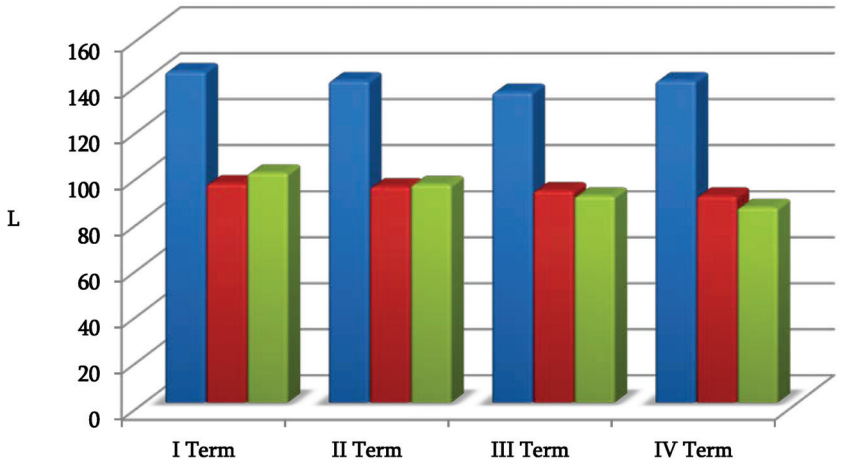

Fig. 1. *L -The height of the trial wheat variety (cm) according to the seed terms per 1m²*

Akhaltsikhe Red Dolly *Tbilisi15* *Sauli9*

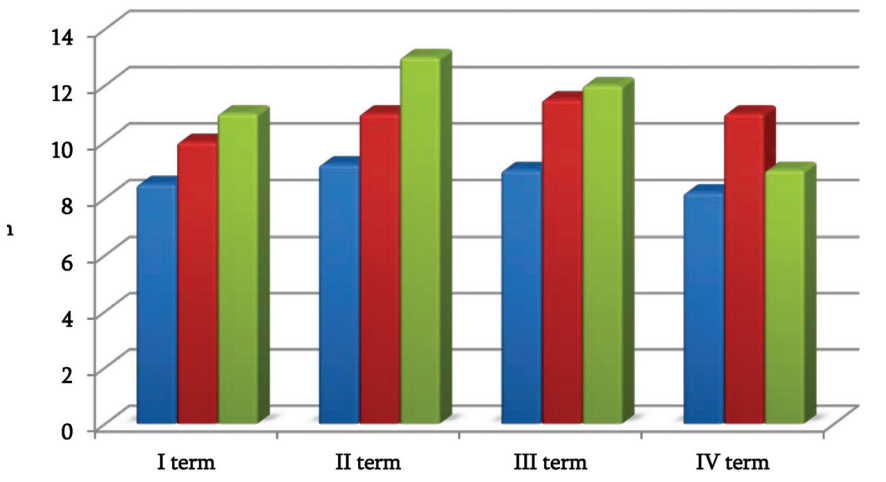

Fig. 2. *The spikelength (cm) per research wheat variety according to the seeding terms on 1m²*

Akhaltsikhe Red Dolly *Tbilisi15* *Sauli9*

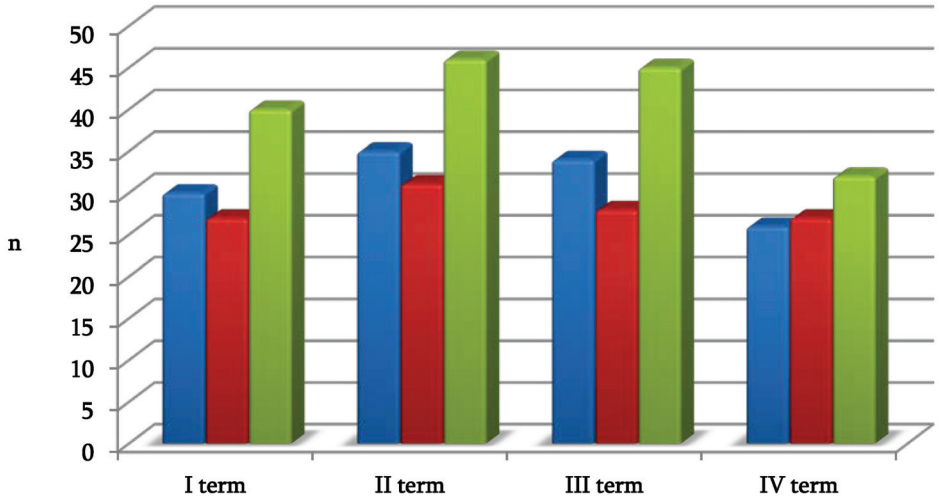

Fig. 3. *Seed number per ear of the research wheat variety according to the seeding terms on 1m²*

Akhaltsikhe Red Dolly *Tbilisi15* *Sauli9*

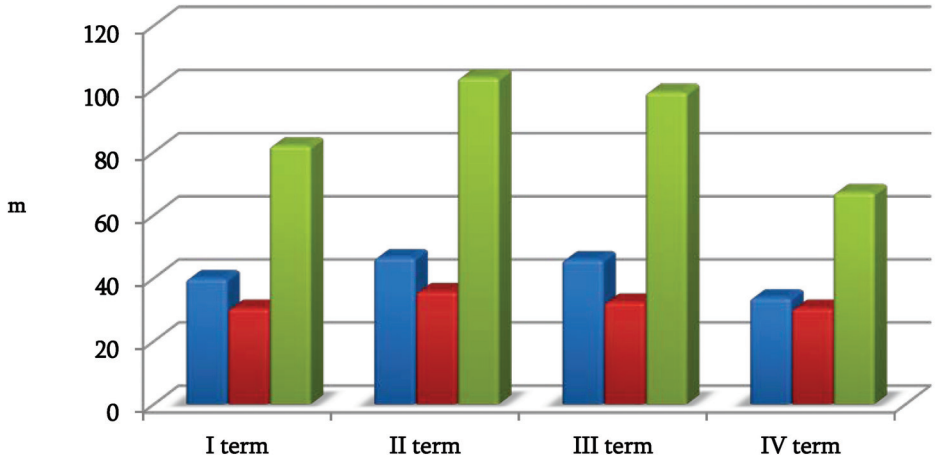

Fig. 4. *Seed weight (in grams) per spike of the research wheat variety according to the seeding terms on 1m²*

Akhaltsikhe Red Dolly *Tbilisi15* *Sauli9*

growth and development and develop recommendations for defining optimal periods for seeding.

As a result of the conducted research, it was found that: In Samtskhe-Javakheti, the optimal period of the wheat seeding was changed;

The previously known dates of sowing were moved forward by around two weeks;

According to our data, the optimal period is from October 1 to October 15.

The wheat seeded during this period is able to grow normally, it winterizes easily, is resistant to the spring frost, it offshoots well; the plant is developed strongly and gives high and quality yield.

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