Physiological Maturation of Grains in Three Different Regions

M. Mahammatova* [1], N. Mavlonova[1], S. Tursoatov[1]

[1]Tashkent State Agrarian University, Tashkent, 100140, Uzbekistan

maxammatovamexriniso@gmail.com

Abstract. The physiological maturation period of wheat and other grains is dependent on various factors, including the biological, ecological, genetic, physiological, and biochemical characteristics of the crop and variety, the cultivation conditions, the hygroscopicity and air permeability of the seed, as well as its anatomical structure, external conditions, and seed moisture. Although immature wheat grains do not have significant negative affect to the amount of flour produced, they lead to lower quality or result in poor-quality dough. The physiological maturation of grains or seeds involves very complex biological and physiological processes, among which the most important is the grouping of protein substances.

Keywords: wheat, grain, physiological ripening, biological, region.

1 Introduction

The high yield and quality of new wheat varieties mostly depend on the correct selection of varieties and their rational distribution across regions.

Physiologically immature seeds either do not germinate or germinate very sparsely [1,2, 11, 12]. If newly harvested wheat grains are quickly ground into flour in a mill, the bread products and dough products, such as pasta, vermicelli, and confectioneries made from them, will be poor quality. Although the physiologically immature wheat grain does not have significantly negative affect the flour yield, it leads to poor quality or results in inferior dough quality. The physiological maturation of grains or seeds involves very complex biological and physiological processes [2, 5], among which the most important is the separation of protein substances into groups. Such processes occur rather slowly in dry seeds and even in flour made from newly harvested grain; the separation of protein substances into groups can continue for several months or even a year.

The physiological maturation period of wheat and other crops, including their grains and seeds, depends on a number of factors, including the biological, ecological, genetic, physiological, and biochemical characteristics of the crop and variety, growing condi-

A. M. Bozdoğan et al. (eds .), *Proceedings of the 5th International Conference on Research of Agricultural and Food Technologies (I-CRAFT 2025)*, Atlantis Highlights in Sustainable Development 8,
https://doi.org/10.2991/978-94-6239-666-1_41

tions, the hygroscopic and air permeability characteristics of the seeds, and their anatomical structure, external conditions, moisture of the seeds, and the hydrophobic or hydrophilic properties of the cells in the endosperm as well as the activity and inactivity of metabolites.

Even if a seed is mature in appearance, it may still be physiologically underdeveloped and have low germination potential. Planting such seeds is risky, as they do not sprout uniformly. The number of seedlings becomes sparse, and the vegetation period is prolonged. Seeds that fail to germinate may swell and perish due to cold exposure. Therefore, it is essential for freshly harvested seeds to undergo a dormancy period. This is especially important in seed production and is a critical step that determines the future yield.

2 Materials and methods

Scientific research was conducted based on the methodological guide "Methods of Conducting Field Experiments" adopted by the former UzNIKhI, mathematical and statistical analysis "Methods of Field Experiment" by B.A. Dospekhov, phenological observations, and field and laboratory research using the "Methods of the All-Russian Research Institute of Plant Growing" methodology [3, 4].

3 Results

In our experiment, when we identified the viability of the seeds that had germinated but were still undergoing physiological maturation every 10 days, differences were noted based on the studied varieties (Table 1) [6-9].

To study the dormancy period of the varieties learned in the experiment, the varieties planted in the Northern region of our republic were placed in the thermostat for germination on July 2. The variety of Gharazsizlik had a productivity of 75%, while the Krasnodar-99 variety had a productivity of 66%. Since the productivity of the varieties did not meet the requirements of the state standard, germination was postponed again on August 2.

Table 1. Physiological maturation of autumn wheat varieties (Northern region)

Name of variety	22-07	22-08	22-09
GarazsizlikSt	75	90	-
Utkir	57	89	-
Uzbekistan-25	54	93	-
Kuren	58	95	-
Hazrati bashir	48	86	-
Yaksart	50	88	-
Bobur	43	86	-
Zamin-1	40	87	-

Durdona	44	86	-
Asr	20	98	-
Ktasnodar-99	66	95	-
Zvezda	52	77	88
Gracia	50	90	-
Zimnitsa	48	86	-
Grom	35	56	86
Moskvich	46	80	86
Moskovskaya-56	76	86	
Zimorodok	70	97	
Vershina	40	61	87
Kalim	64	92	

The results for the varieties were 97% for Zimorodok, 86% for Moskvich, and 90% for Gharnesslik in terms of productivity. The varieties did not meet standard requirements, as the productivity levels [6, 7] were 77% for Zvezda, 56% for Grom, 80% for Moskvich, and 61% for Vershina. Therefore, on September 2nd, these varieties were replanted, and the following results were achieved: 88% for Zvezda, 86% for Grom, 86% for Moskvich, and 87% for Vershina in terms of productivity (Table 1).

Table 2. Physiological maturation of autumn wheat varieties (Central region)

Name of the variety	22-06	22-07	22-08
Hazrati bashir (St)	61	89	-
Yaksart	60	87	-
Bobur	65	80	89
Zamin-1	80	97	-
Durdona	46	86	-
Asr	51	88	-
Chillaki	73	88	-
Yonbosh	42	81	90
Gozgon	59	89	-
Krasnodar-99	66	91	-
Grom	53	86	-
Esoul	40	76	88
Zimnitsa	46	85	-
Zvezda	68	86	-
Sila	68	91	-
Yaksart	54	90	-
Gozgon	60	90	-
Asr	73	90	-
Vassa	82	90	-
Uksak	50	89	-

On June 22, new varieties grown in the Central region were subjected to study for dormancy period at 20°C. The highest rate recorded was 83% in the Chilaki variety,

while the lowest was 42% in the Yonbosh variety. The Bobur variety reached 80%, the Yonbosh variety reached 81%, and the Esoul variety reached 76%. Since the studied varieties in the experiment did not meet the requirements of the state standards, they were subjected to re-treatment on July 22, and the following results were achieved: 89% in the Bobur variety, 90% in the Yonbosh variety, and 88% in the Esoul variety.

The varieties planted in the southern region were placed under the thermostat for germination on June 15 to study the resting period. Since all varieties did not meet the requirements of the state standard, germination was postponed again to July 15. The varieties with the highest productivity were recorded [8, 9, 10] at 90% for the Sanzar-8 variety, 88% for the Termiz-5 variety, and 89% for the Krasnodar-99 variety, while the varieties with the lowest productivity were observed at 78% for the Grom variety, 80% for the Moskvich variety, 52% for the Termiz-6 variety, and 76% for the Termiz-37 variety.

Due to 5 varieties not meeting the standard requirement level, they were placed back on the thermostat on August 15. The Grom variety had a yield of 90%, the Moskvich variety 89%, the Termiz-6 variety 88%, and the Termiz-37 variety 86% (see Table 2)

Table 3. Physiological maturation of autumn wheat varieties (Southern region)

Name of the variety	15-06	15-07	15-08
Hazrati bashir (st)	52	86	-
Yaksart	54	88	-
Bobur	50	86	-
Zamin-1	45	86	-
Durdona	42	87	-
Sanzar-8	54	90	-
Yonbosh	40	81	-
Bunyodkor	41	86	-
Krasnodar-99	64	89	-
Grom	49	78	90
Esoul	45	86	-
Moskvich	48	80	94
Zvezda	53	81	89
Zimnitsa	58	86	-
Kroshka	54	87	-
Gozgon	60	86	-
Termiz-5	62	88	-
Termiz-6	33	52	88
Termiz-20	53	86	-
Termiz-37	35	76	86

In the studied northern region, as of August 22, 2017, the variety Asr had 98%, while four varieties Zvezda, Grom, and Moskvich had 88%, 86%, and 87% respectively as of September 22, reaching their latest physiological maturity (Table 4).

Among the varieties grown in the southern region, the fastest physiological maturity variety reached 90%, with Grom, Moskvich, and Zvezda varieties reaching the standard at 90%, 94%, and 84%, respectively, as of July 15.

In the central region, the varieties produced show 97% for the Zamin-1 variety, 89% for the Bobur variety, 97% for the Yonbosh variety, and 88% for the Esaul variety, with physiological maturity observed at 22.08.
Graphs were developed to show the relationship between germination rate and physiological maturation period of wheat varieties (Figure 1) [6–9].

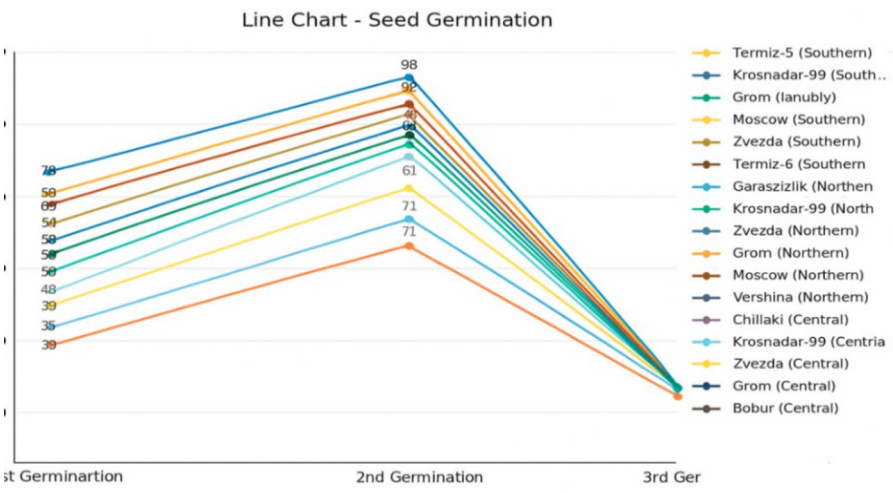

Fig. 1. Line chart- seed germination.

Table 4. Rest period duration of the seeds.

№	Name of the variety	1- germination, %	2- germination, %	3- germination, %
Southern region		**15.VI**	**15.VII**	**15.VIII**
1	Termiz-5	62	88	-
2	Krasnodar-99	64	89	-
3	Grom	49	78	90
4	Moskvich	48	80	94
5	Zvezda	53	81	89
6	Termiz-6	33	52	88
Northen region		**2.VII**	**2.VIII**	**2.IX**
1	Garasizlik	65	90	-
2	Krasnodar -99	66	95	-
3	Zvezda	52	71	88
4	Grom	35	56	86
5	Moskvich	46	80	86
6	Vershina	40	61	87
Central region		**22.VI**	**22.VII**	**22.XIII**
1	Chillaki	73	98	-
2	Krasnodar-99	66	91	-

3	Zvezda	60	86	-
4	Grom	53	86	-
5	Bobur	65	80	89
6	Yuksak	42	81	90

4 Conclusion

According to the analysis of the resistance of various autumn soft wheat varieties to stress factors in different regions, it was noted that in the conditions of Surkhandarya region, the varieties Termiz-5 and Krasnodar-99 had high productivity, while in the conditions of Karakalpakstan, the varieties Gharaqsizlik and Krasnodar-99 showed high productivity. In the genetic resources of plants at the Institute, the varieties Chilkaki, Krasnodar-99, Zvezda, and Grom were also noted to have high productivity. In conclusion, it can be said that the physiological ripening of seeds significantly affects the emergence of spring wheat varieties. Among the studied varieties in the northern region, as of August 22, 2017, the Asr variety had 98%, while four other varieties, Zvezda, Grom, and Moskvich, had physiological ripening rates of 88%, 86%, and 87% respectively as of September 22 (Table 4).

Among the varieties grown in the southern region, the fastest to reach physiological maturity was 90%, as of July 15. The varieties Grom, Moskvich, and Zvezda reached standards at 90%, 94%, and 84% respectively. In the central region, the variety Zamin-1 reached 97% as of July 22, while the variety Bobur reached 89%, the variety Yonbosh reached 97%, and the variety Esaul reached 88%, with physiological maturity observed as of August 22.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Makhammatova M., Ashurov M., Tursoatov S., Fayzullaev A. Scientific basis of appropriate sowing of wheat varieties on irrigated land of Uzbekistan // 2nd International Conference on Energy, Civil and Agricultural Engineering. Pp. 1-14 (IOP Conf. Series: Earth and Environmental Science 939 (2021) 012079; doi:10.1088/1755-1315/939/1/012079
2. Komolitdin Sultonov, Guzal Kholmurodova, Jamoliddin Eshonkulov, Kholik Allanov, Obidjon Sindarov, Kholmurod Khayitov, Jamila Khaitbaeva, Shavkat Salomov, Sabirjan Isaev, Altingul Djumanazarova, Risolatxon Imyaminova, Nodirakhan Jurayeva, Mavluda Karimova, Lobar Khayrullaeva, Nodirakhon Yakubjonova, Normat Durdiev, Rano Yuldasheva and Botir Khaitov. Effect of integrative NPK soil and foliar nutrition on winter wheat (*Triticum aestivum* L.) productivity in irrigated arid lands
3. Shadman Namazov, Guzal Kholmurodova and Rano Yuldasheva. Cotton Breeding, Seed Production, and Agrotechnologies Research Institute, Tashkent, Uzbekistan. Indications of High-Generation Convergent Hybrids Based on Transgressive Recombination Prints in Cotton.

4. Guzal Kholmurodova, Gulchekhra Tangirova, Aziza Saidova and Sevara Bozorova. Tashkent State Agrarian University, Uzbekistan, Inheritance, variability and formation of crop productivity elements.
5. Kholmurodova G.R., Namazov Sh. E., Mirkhomidova N.A., Matyakubov S.K., Yusupov A.Kh., Rustamov N.S., Mashrapov H.T. Analyzing formation of fiber the length of selection materials created by means of several types of hybridization methods in breeding G. hirsutum L. varieties; European Journal of Molecular & Clinical Medicine ISSN 2515-8260 Volume 8, Issue 1, 2021. P.1316.
6. Juraev S., Djumashev M., Ashurov M., Jamolova L. Analysis of Valuable and Economic Features of Introgressive Hybrids of Cotton in Different Soil and Climatic Conditions of Uzbekistan. Fundamental and Applied Scientific Research in the Development of Agriculture in the Far East (AFE-2024) Agricultural Cyber-Physical Systems, Volume 1. P. 627-638. https://doi.org/10.1007/978-3-031-37978-9
7. Jurayev S., Rakhmankulov M., Yakubjanova N. Study of the Value and Economic Characteristics of F3 Hybrids of Different Genetic Origin in the Conditions of Tashkent, Fergana and Kashkadarya Provinces. Uzbekistan. Fundamental and Applied Scientific Research in the Development of Agriculture in the Far East (AFE-2024) Agricultural Cyber-Physical Systems, Volume 1. P. 689-699. https://doi.org/10.1007/978-3-031-37978-9
8. Juraev S., Jumashev M., Khudarganov K., Nazarov Kh**.** Evaluation of qualitative parameters of fiber in cotton hybrids grown in various regions of Uzbekistan. IOP Conference Series: Earth and Environmental Science. ICECAE-2022. IOP Conf. Series: Earth and Environmental Science 1142 (2023) 012084 IOP Publishing doi:10.1088/1755-1315/1142/1/012084. https://iopscience.iop.org/issue/1755-1315/1142/1
9. Juraev S., Makhammatova M., Jumashev M., Ashurov M. Variability of main value-economic characteristics of F_2-F_4 hybrids of cotton in different soil-climateregions of Uzbekistan. IOP Conference Series: Earth and Environmental Science. ICECAE-2022. IOP Conf. Series: Earth and Environmental Science 1142 (2023) 012084 IOP Publishing doi:10.1088/1755-1315/1142/1/012092 https://iopscience.iop.org/issue/1755-1315/1142/1
10. S Egamberdieva, S Juraev, U Kurbanov. Variability of fiber gin turn out in cotton hybrids of the species G.hirsutum L. in different growing zones. I-CRAFT, Agricultural and Food Technologies Collection. ISBN: 978-625-99572-2-7, Collection of I-CRAFT 2024
11. Toreev F., Urazov B., Shodmonova G., Allambergenov T., Mavlonova N. Fiber Quality Indexes of Newly Developed Cotton Lines and the Test Results in The Enlarged and Small Nurseries. AIP Conference Proceedings 2432, 040023 (2022); https://doi.org/10.1063/5.0091143.
12. M.I Annaeva, F.N Toreev, M.M Yakubov, B.D Allashov, N. Mavlonova, S Tursoatov..Agrotechnology of Melilotus albus cultivation in saline area. 2020/12/1IOP Conference Series: Earth and Environmental Science.