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Field and laboratory studies of drought resistance of local and introduced common wheat genotype (Triticum aestivum L.)

Elnare A. Huseynova

Ganja State University
Ganja, Azerbaijan
Azerbaijan State Agrarian University
Ganja, Azerbaijan
E-mail: elnare.huseynova.1979@mail.ru

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There is no conflict of interests

РЕЗЮМЕ

Relevance and methods. The study included 32 local (materials from the "Grain and Grain and Bean Crops" department of the Institute of Genetic Resources of ANAS) and 25 CIMMYT (International Center for Corn and Wheat Improvement).In total, 57 (Triticum aestivum L.) soft wheat varieties which belong to autumn were irrigated under field conditions and the amount of chlorophyll in leaves under drought conditions was based on the Inada method (Inada, 1965. Minolta, 1989).The effects of stress factors on physiological processes, especially drought on chlorophyll a and chlorophyll b depression, were investigated using SPAD 502 Plus (Spectrum Technologies, USA) in the condition laborotory.At the same time, the amount and a / b ratio of chlorophyll (a + b) were calculated and diagnostic methods were evaluated for the drought tolerance stress of the samples.

Results. As a result of the study, 21 wheat samples from 57 wheat samples in the field condition (16 local, 5 introduced), and 25 samples in laboratory conditions (13 indigenous, 12 introduced)were shown drought tolerance. Generally,there have been observed an increase in the amount of chlorophyll while study amount of chlorophyll on the sail leaves of the wheat plant with SPAD meter in laboratory conditions13 genotypes showing drought tolerance. These examples are Birlik (AZE), Durdane (AZE), Mirbashir 128 (AZE), Taraqqi (AZE), Akinchi 84 (AZE), Giymetli 2/17 (AZE), Sheki 1 (AZE), Murov 2 (AZE), Gobustan. (AZE), MV06-02 (HU-MV), TX96V2847 (US-TX), Sonmez (TR-ESK), SG-S1915 (CZ) selected for their resistance to drought stress and from these samples in the selection work on the continuity and they are also recommended to use as a starting material.

Полевые и лабораторные исследования засухоустойчивости местного и интродуцированного общего генотипа пшеницы (*Triticum aestivum* L.)

Гусейнова Е.А.

Гянджинский государственный университет
Гянджа, Азербайджан
Азербайджанский Государственный Аграрный Университет
Гянджа, Азербайджан
**E-mail: elnare.huseynova.1979@mail.ru*

Ключевые слова: мягкая пшеница, Triticum aestivum L., хлорофилл, стресс, засуха, продовольственная безопасность, фотосинтез.

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Конфликт интересов отсутствует

ABSTRACT

Актуальность и методы. В исследование были включены 32 местных (материалы из отдела «Зерновые и зерновые и бобовые культуры» Института генетических ресурсов НАНА) и 25 CIMMYT (Международный центр улучшения кукурузы и пшеницы). Всего 57 образцов Triticum aestivum L. Количество хлорофилла в листьях в условиях засухи учитывали по методу Инада (Inada, 1965; Minolta, 1989). Влияние факторов стресса на физиологические процессы, особенно засухи, на депрессию хлорофилла a и хлорофилла b исследовали с использованием SPAD 502 Plus (Spectrum Technologies, США) в условиях лаборатории. В то же время рассчитывали количество и соотношение a/b хлорофилла (a + b) и оценивали диагностические методы для стрессоустойчивости образцов.

Результаты. В результате исследования 21 образец пшеницы в полевых условиях (16 местных, 5 интродуцированных) и 25 образцов в лабораторных условиях (13 местных, 12 интродуцированных) показали засухоустойчивость. Образцы: Birlik (AZE), Durdane (AZE), Mirbashir 128 (AZE), Taraqqi (AZE), Akinchi 84 (AZE), Giymetli 2/17 (AZE), Sheki 1 (AZE), Murov 2 (AZE), Gobustan. (AZE), MV06-02 (HU-MV), TX96V2847 (US-TX), Sonmez (TR-ESK), SG-S1915 (CZ) рекомендуется использовать в качестве исходного материала для селекции.

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Introduction

In recent years, the global population and the global climate and environmental changes are also experiencing a growing demand for food. In this regard, ensuring food security has become a universal problem [5]. The solution to this problem plays an important role in meeting the demand for wheat from the priority plants (Triticum aestivum L.). Cultural wheat varieties, on the basis of their nutritional value, cover more than 20% of the daily calorie and protein content in the food introduction[1]. At present, the production of wheat and its position in the world market are crucial in ensuring food security of the countries, and the total cultivated area of this plant is more than 220 million hectares [7].

There are a number of factors affecting the growth and development of wheat plant, including the extreme factor of drought, which can result in changes in the organism of the wheat plant morphological, physiological, and biochemical levels, leading to its retardation and consequently its high productivity. As a result of the current climate change, the drought is becoming more and more active in the globalized world, expanding its reach and covering more areas over the next 30–90 years [9]. The main reason for the decrease in wheat productivity due to the stress of drought is the most negative effect on the leaves in vegetative organisms, because photosynthetic activity in wheat plant is mainly absorbed by the surface of the leaf [8]. As a result of the drought, the turgor process in the wheat plant weakens, the plasmolysis situation occurs when the mouths are either completely closed or opened in an unflattering state, thus disrupting normal processes such as photosynthesis, which directly affect grain productivity.Also, the water deficiency can negatively affect the biochemical processes involved in the photosynthesis process, thus preventing CO_2 from free entering the mouths.Initial products produced during photosynthesis cannot be transmitted to other organs because of the effects of drought, accumulate in leaves and cause disorders [10]. The drought caused by climate change is caused by the drought, which occurs at the stage of soft wheat production, as well as in other countries, leading to significant crop losses in Azerbaijan. Therefore, the creation of drought-resistant soft wheat varieties is of particular importance for Azerbaijan.

The main purpose of the research to identify changes in the amount of chlorophyll in the leaf due to the effects of drought stress of wheat plant in field and laboratory conditions and revealing highly productive genotypes that are drought-resistant.

Materials and methods

The study used 57 varieties of wheat with different biological characteristics, 32 of which are local, including materials from the "Grain and Grain and Bean Crops" department of the Institute of Genetic Resources of the Academy of Sciences of the Republic of Azerbaijan, 25 of which are introduced CIMMYT(International Center for Corn and Wheat Improvement)-from autumn soft wheat variety (Table). In field conditions, the study material was scattered at 50 wheat from each specimen corresponding to the requirements of the international descriptor, with a seed distance of 4 cm and a line distance of 25 cm.

In the study, the amount of chlorophyll in leaves irrigated under field conditions and in drought conditions was measured using SPAD 502 Plus (Spectrum Technologies, USA), developed based on the Inada method (Inada, 1965. Minolta, 1989). In each sample, measurements were made in the middle of the last sowing leaf of 10 plants.

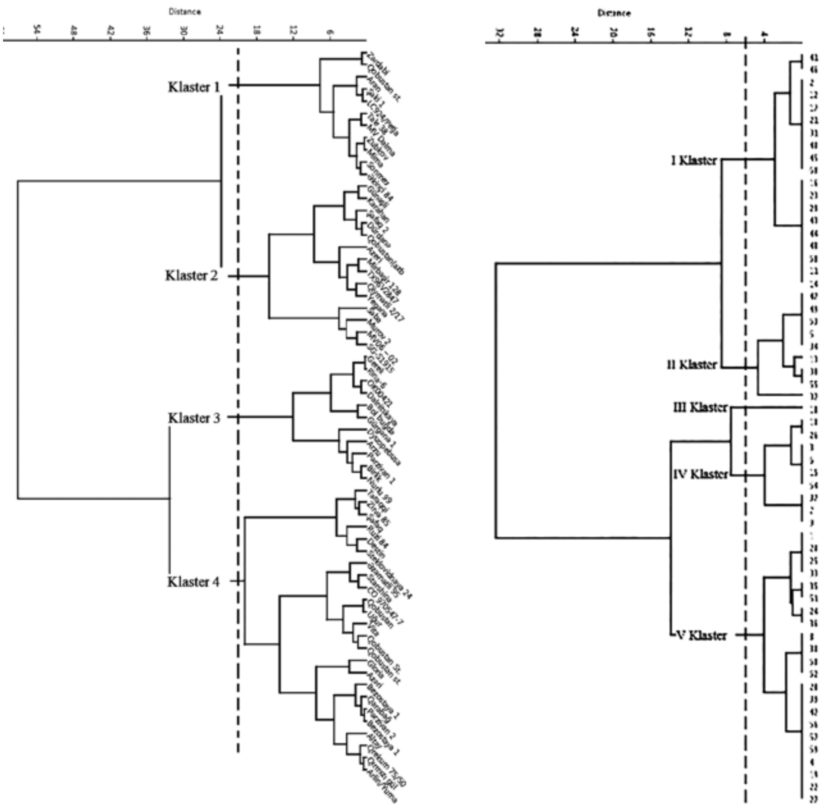
Таблица 1. **Коэффициенты переваримости питательных веществ рациона, %**

Table 1. **Digestibility ratios of nutrients in the diet, %**

№	Variety	Origin	№	Variety	Origin
1	Gobustan	AZB	30	Tale 38	AZB
2	Bol bughda	AZB	31	Murov 2	AZB
3	Arzu	AZB	32	Gırmızı gul 1	AZB
4	Birlik	AZB	33	Gobustan	AZB
5	Gurgana 1	AZB	34	Bezostaya 1	TR
6	Garabagh	AZB	35	Starshina	RUS
7	Aran	AZB	36	CO970547-7	USA
8	Zardabi	AZB	37	Zubkov	KYR
9	Parzivan 1	AZB	38	MV 06-02	HU
10	Parzivan 2	AZB	39	Gerek	TR
11	Grekum 75/50	AZB	40	Gloriya	RO
12	Durdana	AZB	41	TX96V2847	USA
13	Mirbashir 128	AZB	42	Arlin/Yuma	USA
14	Tərəggi	AZB	43	MV Dalma	HU
15	Azeri	AZB	44	Destin	RO
16	Akinchi 84	AZB	45	Dyuopebusa	MOL
17	Giymətli 2/17	AZB	46	OK00421	USA
18	Zirvə 85	AZB	47	Altay	TR
19	Nurlu 99	AZB	48	Mima	BG
20	Azamatli 95	AZB	49	LC927/Petja	BG
21	Sheki 1	AZB	50	Sönməz	TR
22	Ruzi 84	AZB	51	Steklovidnaya 24	KAZ
23	Guneshli	AZB	52	Dalnitskaya	UKR
24	Shafag	AZB	53	Vita	RUS
25	Saba	AZB	54	Azeri	AZB
26	Shafag 2	AZB	55	SG-S1915	CZ
27	Ugur	AZB	56	Karahan	TR
28	Yegana	AZB	57	U1254-7-9-2-1/ TX86A5616// Rina-6	TCI

*AZB — Azerbaijan, RUS — Russia, KYR — Kyrgyzstan, HU — Hungary, TR — Turkey, RO — Romania, MOL — Moldova, BG — Belgium, KAZ — Kazakhstan, UKR — Ukraine, CZ-Czech

Fig. 1–2. Classification of wheat samples based on changes in the amount of chlorophyll caused by drought under field (Figure 1) and laboratory (Figure 2)



Mirbashir 128, Durdane, Akinchi 84, Giymetli, Saba,Shafaq 2, Yegane, Gobustan, Murov 2, Zubkov, MV06-02, TX96V2847, MG, Azeri, S1915 and Karahan varieties have been shown to be resistant to the effects of drought stress, and they have a high effect by changing the amount of chlorophyll to 50.0–56.1. In general, an increase in total chlorophyll content in the leaf is a reaction of plants to their thirst. As a result of the drought stress, the assimilation surface area of the soft wheat genotypes leaves, the dry biomass, the permeability of the mouths, and finally the slowdown of the transpiration process, resulted in a reduction in the amount of chlorophyll on the leaves of 71.9% samples .

Diagnostic methods used to determine the resistance of plants to drought stress contribute to the detection of changes in the amount of chlorophyll (a + b) in leaves. In laboratory conditions, 53.0% of wheat samples were exposed to chlorophyll reduction due to drought. Drought under stress has a significant negative impact on the normal course of photosynthesis, which plays an important role in the productivity gains and has shown a decrease in the performance of the elements. There was a significant increase in the amount of chlorophyll (a + b) caused by drought in 47.0% of the samples in the study, which allows for high yields, which are considered drought-resistant samples.

The tolerance index was calculated in both conditions based on changes in the chlorophyll content, and a dendogram was generated using the SPSS statistical software (Fig. 1, 2).

In the cluster, genotypes are divided into four (Figure 1) and five (Figure 2) groups for drought resistance. In both conditions, genotypes occurring in the first cluster are genotypes resistant to drought stress. In the second cluster, localized samples were evaluated as relatively drought-resistant species. In another cluster, there was a sharp decrease in the amount of chlorophyll in the leaves of localized varieties, which were recorded as drought-resistant varieties.

During the research 16 local drought-resistant in the field condition ,5 were introduced of the 21 samples, 15 samples were localized in cluster 1 and 2 (Figure 1).From theses samples 10 local,5 were intoduced.According to laboratory studies, 25 drought-resistant samples were localized in cluster 1 and 2 (Figure 2), with 13 of these samples are local, 12 of them are indroduced. A total of 13 genotypes are genotypes of chlorophyll increase in drought tolerance during both SPAD meters and laboratory studies of chlorophyll content, 9 of which were local, 4 were introduced (Birlik, Durdana, Mirbashir, 128;Giymetli 2/17, Sheki 1, Akinchi 84,Murov 2, Gobustan, MV06-02, TX96V2847, Sonmez, SG-S1915).

According to the results of the research, photosynthesis of high-yielding varieties of plants is of great importance, since photosynthesis plays an important role in the accumulation of biological products of plants and the

Measurement of chlorophyll content in the leaves of the samples was performed each five days for three times, starting with the wheat spike phase. In the laboratory, 100 seeds were counted, transferred to sterile petri dishes and placed on a thermostat with a temperature of 220C,20-30 leaves, 10-15 cm long, stumbled slightly and weighed 6 pounds per 100 mg,10 ml of 96% ethyl alcohol was added on 3 weight and 20atm pressure sucrose solution was added over the other 3 weight and stored at 240C for one day. The leaf particles in the sucrose solution were then removed from the solution and dried with filter paper and added 10 96% ethyl alcohol. After completely moving the chlorophyll to alcohol, the volume of alcohol in the test bottle was 10 ml and the chlorophyll content was measured on a spectrophotometer at wavelengths of chlorophyll "a", 665 nm, chlorophyll "b" 649 nm [9]. The SPSS analysis software was used as a statistical method.

Conclusions and their discussion

A comparative study of the amount of chlorophyll pigment, the main photosynthetic pigment of chloroplasts, has been studied in the collection of photosynthetic productivity, which is important in the formation of productivity in local and intra-soft wheat samples studied under normal and drought conditions. The data collected was checked in the statistical program. Valid 2/17, Ruzi 84, Gunesh, Shafag, Shafag 2, Ugur, Tale 38, Murov 2, Girmizi Gul, Starshina, CO970547-7, Zubkov, MV06-02, Gloria, When studying the amount of chlorophyll in leaves under SPAD meters under irrigation conditions MV Dalma, Destin, Bezostaya 1, Duopbusa, OK00421, Mima, LC924/Petja, Dalnitskaya, Vita, Azeri, SG-S1915 outperformed other samples with a change of 50.9-56.8 units. Based on the three-year average statistics of chlorophyll content in soft wheat varieties, process of conversion of light energy into chemical energy is more intense [4, 3].

Thus, high-yielding varieties of plants differ from relatively low-yielding varieties for their photochemical activity of chloroplasts (FKF) and high absorption rate of CO_2 [2] and which there is more chlorophyll and CO_2 absorption takes place the surface of leaf creates condition to determine the potential for photosynthesis for high productivity.

According to the results of the study, samples selected for resistance to drought stress due to chlorophyll content can be sown in suitable areas and can be used as donors in drought-tolerant breeding.

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ОБ АВТОРЕ:

Гусейнова Ельнаре Алиш кызы, докторант АГАУ, преподавательница ГГУ,

ABOUT THE AUTHOR:

Huseynova Elnare Alish, doctoral student in ASAU, teacher in GSU

НОВОСТИ • НОВОСТИ • НОВОСТИ • НОВОСТИ • НОВОСТИ •

Сельхозпроизводители наращивают закупки минеральных удобрений

По данным Российской ассоциации производителей удобрений (РАПУ), в первом полугодии поставки минеральных удобрений на внутренний рынок, по сравнению с аналогичным периодом прошлого года, выросли на 15,6% – до 6,4 млн т. В РАПУ отмечают, что закупки минеральных удобрений шли с опережением годового графика благодаря тому, что российский рынок имеет приоритет для отечественных производителей.

Объемы использования минеральных удобрений, сформулированные Минсельхозом России, были полностью выполнены. Предприятия отрасли смогли обеспечить высокую динамику поставок благодаря масштабным инвестициям в развитие производственных мощностей и региональной логистической инфраструктуры. За последние 5 лет объем инвестиций компаний РАПУ превысил 800 млрд руб. На ближайшие годы отраслевыми предприятиями запланирован объем капиталовложений на уровне 1 трлн руб. Растущему спросу во многом способствует и доступность минеральных удобрений для сельхозпроизводителей, которая поддерживается Минсельхозом России, региональными органами АПК и производителями минеральных удобрений.

Ранее в своем выступлении, сделанном по итогам весенних полевых работ, первый замминистра сельского хозяйства Джамбулат Хатуов отмечал важность увеличения доли жидких комплексных минеральных удобрений. Они эффективно зарекомендовали себя на малопродуктивных землях и в том числе в засушливых регионах Российской Федерации.

По оценкам Минсельхоза, внесение минеральных удобрений увеличится в этом году до 53 кг/га в действующих веществах. В прошлом году этот показатель составлял 48 кг/га.