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Article

Breakthrough in Combating Yellow Rust Boosts Wheat Yield and Quality

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Abstract: This article presents modern methods of combating yellow rust disease, emphasizing research at the Southern Agricultural Research Institute. The most effective, inexpensive, and environmentally safe method to combat agricultural diseases is planting resistant, high-yielding, and high-quality grain varieties. Studying the virulence structure of rust diseases is crucial for grain production, as identifying and using effective resistance genes based on laboratory analyses can significantly combat rust diseases in grain crops. The research involved virulence testing of differentiating cultivars with specific genes, using a combination of global and European varieties, and optimal rust development techniques, including nitrogenous Norus fertilizer and Soltrol 170 for inoculation. The evaluation followed the 0-4 scale by C. Wellings et al. (1986). Marker-assisted selection (MAS) identified new breeding materials resistant to yellow rust, leading to new soft wheat varieties that can increase irrigated field productivity by 10-15 t/ha, addressing the demand for high-quality grain products.

Keywords: Soft Wheat, Inoculation, Encapsulation, Grain, Yellow Rust.

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1. Introduction

Epidemics of yellow rust (Puccina striiformis f.s. tritici), which has become the main problem in world grain farming and causes the greatest economic loss in soft wheat cultivation, naturally did not leave our Republic, and on the contrary, it became one of the main "hotspots" of this disease in the world. Almost all of the 25-30 varieties of soft wheat grown in the main area have been found to be susceptible to these rust diseases[1].

In recent years, most of the varieties planted in the grain fields of the republic are causing serious damage to the grain productivity due to their intolerance, and in the case of the Kashkadarya region, the average cost of chemical control against them is 8-12 billion. is making up soum[2]. In order to solve this problem, it is necessary to create varieties with genes for resistance to rust diseases, which will have a good effect in the fight against rust diseases in the grain crops of our republic, and to determine the virulence and avirulence of rust disease races in differentiating varieties, and to create varieties with genes that are absolutely resistant to newly spread races[3].

2. Materials and Methods

Currently, there is a set of genotypes with specific genes for resistance to yellow, brown and stem rust, which is being sent by the International Scientific Center of ICARDA to the countries involved in the cultivation of whole grains [4]. According to the experiments carried out in the Yellow Rust Trap Nursery, which contains differentiating varieties with identified genes responsible for yellow rust disease in Uzbekistan, we now

have effective Yr5, Yr10, Yr15, Yr17, Yr27 genes, and these genes give the plant resistance to local races of the fungus that causes yellow rust disease. provided by [5].

New genes can appear unexpectedly due to sudden random re-mutations or rearrangement of the pathogen's genetic material due to genetic variation that occurs continuously in the organism. Such pathogenic individuals may have existed before, but are a very small fraction of the total pathogen population, and the variety with the new resistance gene was very rare before large-scale cultivation [6].

But when such resistant plants are cultivated, the new resistance gene kills or inactivates all but a very small number of pathogen individuals with the new virulence gene that can infect these plants[7]. The death or suppression of pathogens without the new gene allows a very small number of pathogens with the new gene to multiply and replace the extinct pathogen population.

The most effective, inexpensive and environmentally safe ecological method of combating any disease in agriculture is to plant a resistant, high-yielding and high-grain quality variety. In this regard, the study of the virulence structure of rust diseases is of great scientific and practical importance for grain production [8].

This, in turn, based on laboratory analysis, identification of the genes of rust diseases in the fight against rust diseases and the use of effective genes will have a good effect in the fight against rust diseases in the grain crops of our republic[9].

Yellow rust virulence test: Differentiating cultivars containing specific genes and gene combinations should be grown in laboratory conditions to study the rasa composition. 9 of these differentiators include global and 7 European varieties [10]. In order to ensure good rust development in differentiating varieties, watering with nitrogenous Norus fertilizer one week after germination and 10 days after inoculation is effective. Soltrol 170 is used during the inoculation process and placed in a dark room at 9oC at 100% humidity for 24 hours after inoculation[11]. Evaluation work in differentiating varieties after 15 days C. Wellings et al. conducted in 1986 based on the 0-4 scale[12].

3. Results

The composition of pathogens causing rust diseases is studied and aggressive races are isolated, and wheat lines that are resistant to these aggressive races and are resistant to these aggressive races, with the help of genome selection MAS (marker-based selection), new breeding materials with genes resistant to yellow rust disease are selected, and they are involved in practical selection work in creating soft wheat varieties. will be done. The technological quality indicators of the selected lines are analyzed, new promising varieties are created using their extensive selection methods, and the initial breeding of the new varieties is intensively organized, and sara seeds are prepared and introduced.

4. Discussion

In laboratory conditions and in field conditions, it is artificially infested with rust diseases, and conditions for the development of rust diseases are created with the help of a water mist spraying device[13], therefore, as a result, disease-resistant varieties require the selection of samples resistant to aggressive genes in the ridges[14].

Varieties and lines are grown in field laboratory conditions, resistant varieties and lines are selected after being artificially infected with yellow rust spores, and new lines with high yield[15], grain quality and breadiness are created using DNA markers genetically linked to yellow rust disease resistance and technological quality indicators, and nutritional quality indicators of grain are evaluated with the help of modern tools and equipment, and lines with high content of protein and gluten in grain are selected[16].

Table 1. Code and genes of a set of differentiating varieties of wheat in the world

A collection of differentiating varieties	Kod	Genes
World		
Chinese 166	$1(=2^0)$	Yr1
Lee	$2(=2^1)$	Yr7
Heines Kolben	$4(=2^2)$	Yr6,Yr2
Vilmorin	$8(=2^3)$	Yr3V
Moro	$16(=2^4)$	Yr10
Strubes Dickkopf	$32(=2^5)$	YrSd
Suwon92 x Omar	$64(=2^6)$	YrSu
Clement	$128(=2^7)$	Yr9,Yr2+,Cle
Triticum spelta	$256(=2^8)$	Yr5
Europe		
Hybrid 46	$1(=2^0)$	Yr4+
Reichersberg42	$2(=2^1)$	Yr7+
Heines Peko	$4(=2^2)$	Yr6,Yr2+
Nord Deprez	$8(=2^3)$	Yr3N
Compair	$16(=2^4)$	Yr8,YrAPR
Carstens V	$32(=2^5)$	Yr32,YrCv
Spaldings prolific	$64(=2^6)$	YrSp
Heines VII	$128(=2^7)$	Yr2+

5. Conclusion

It can be said that with the help of MAS (marker-based selection) of genome selection, new breeding materials containing genes resistant to yellow rust disease are selected, and as a result of creation of new generation soft wheat varieties, the productivity of irrigated fields can be increased by 10-15 t/h. This will serve to satisfy our people's demand for high-quality grain products

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