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Multiline to Combat Against Plant Diseases

Gaurav Rakhonde[1], Shalaka Ahale[2], Himani Jeena[3] and Kumari Surbhi[3]

[1]Department of Plant Pathology, University of Agricultural Sciences, GKVK, Bangalore
[2]Department of Plant Pathology, Punjab Agricultural University, Ludhiana
[3]Department of Plant Pathology, College of Agriculture,
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar

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Introduction

Traditional tactics of exploiting genes for vertical resistance have typically failed to provide long-term disease control. Multiline is a group of isogenic lines that varies in terms of resistance genes where the crop is phenotypically homogeneous in this technique, differing from one another in terms of the many diseases and pests that they encounter. They react differently because their genetic composition for disease and pest resistance is diverse. Jenson (1952) and Borlaug (1953) proposed a strategy for diversifying resistance genes, assisting in postpone or avoid the emergence of new races while stabilizing the rust population. This is a varied population with horizontal resistance, which is thought to be more stable and long-lasting throughout time.

Good Multiline

For each disease, the line must have a specified resistance and must be able to last for a longer time. Multiline component lines are expected to be uniform in terms of agronomic features, with the exception of disease resistance. To the greatest degree feasible, it must have a high yield.

Mechanisms of Action

- **Barrier Effect and Dilution:-** The incidence of disease spread between plants is lowered by increasing the distance between susceptible plants and are hampered by the presence of resistant plants in the canopy. The spread of disease can be delayed by reducing the number of susceptible plants in the population. *Blumeriagraminis* f. sp. *hordei* can be controlled using a multiline crop cultivar with an optimal spatial arrangement of host genotypes. The blockage of disease inoculum can also create a

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barrier effect. The efficacy of the cultivar combination in dilution and barrier effect mechanisms is determined by the size of the host plant.

- **Induced Resistance:-**The defensive actions in sensitive plants are triggered by avirulentpathogens on certain host genotypes. The race causes a biochemical host defensive mechanism known as induced resistance, which inhibits the generation of new disease races and reduces secondary dissemination. With these multiline crop varieties, this is especially important in the management of wheat stripe rust and barley powdery mildew.
- **Microclimate Modification:-** The features of crop cultivar components that are more essential in disease control might alter the microclimate. In the control of rice blast with multiline crop cultivars, microclimate variables, particularly humidity, have a vital influence.

Disease Management

Air-Borne Pathogens:

Multiline cultivars limit propagule spread of airborne diseases to susceptible plants. This method decreased wheat powdery mildew infection by 35% from race-specific resistant transgenic wheat lines, produced from Pm3a, Pm3c, Pm3d, Pm3f or Pm3g. Furthermore, even a multiline blend of two cultivars may effectively control *Puccinia triticina* on *Triticum vulagre*. Random combinations are also efficient in reducing crown rust in oats. Due to the planting of resistant and susceptible cultivar mixes, the incidence of *Magnaporthe grisea* on paddy has been significantly decreased, resulting in greater yield. Similarly, in late blight of the potato, combinations drop to 36–37%. In Latin American nations, planting multiline cultivars of *Coffea* spp. reduces the prevalence of rust disease.

Soil-Borne Pathogens:

Wheat eye spot disease can be reduced by combining cultivars. The soil-borne mosaic virus disease of wheat is spread by *Polymyxagraminis* zoospores, may also be treated through cultivar mixes. Cultivar mixes with 17–33% resistant plants can control crown and root rot disease in sugar beets.

Viral Diseases

In a 1:1 ratio of susceptible to resistant lines of oat crop, yellow dwarf virus infection was reduced as the aphid population may be disrupted as a consequence of diversity and their

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feeding period, resulting in a decrease in viral transmission. Soissons and Tremie wheat cultivars decline soil-borne mosaic disease in *Triticum vulgare* by using a 1:1 and 3:1 ratio of wheat cultivars.

Multiple Diseases

One or more resistant lines of mixture were used to control many illnesses. In combinations, the two wheat cultivars resistant to *Pyrenophoratritici-repentis* create tan spot while the other to *Puccinia triticina* induce leaf rust. As a result, diseases get controlled.

Merits of Multiline

In terms of agronomic qualities multilines are essentially identical to recurrent parent. A few or a few lines of the multiline combination are susceptible to the disease in any given crop season, the cultivar failure rate should be modest. The disease may spread more slowly than if the entire population is susceptible to the pathogen as susceptible lines may be in few numbers in the field, reducing damage to the susceptible lines. A multiline offers horizontal resistance and increases the durability of resistance genes. On a worldwide scale, the likelihood of the pathogen population homogenizing is lowered and epidemics can be avoided. Crop output can therefore be attained through stabilization and optimization. Even if the disease isn't present, certain multilines may reject the recurrent parent. Multilines slowed the establishment of new races in the pathogen population.

Challenges

When the racial makeup of the pathogen changes, the farmer must replace the multiline seeds. A newly developed virus might potentially target all of the current lines. By maintaining their component lines, multiline production and maintenance is a time-consuming and ongoing operation. A multiline variety created from its recurrent parent may be supplanted by other superior kinds accessible over time. Multiline variety should be reconstituted on a regular basis and new component lines should be designed with the future in mind. The procedure of seed certification is fairly complicated.

Achievements

Miramar 63 was the first wheat multiline cultivar to be released for commercial cultivation under the Colombian Wheat Rust Program and Miramar 65 was also shaped afterwards. To combat oat crown rot, Iowa State University developed and distributed 14 different oat crop multilines, including E68, E70 (both early), M68, M69 (both mid-season),

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and others. In the Netherlands, a winter multiline Tumult was launched to combat wheat yellow rot. Punjab Agricultural University, Ludhiana released Sonalika Multiline-1 with six components to combat both brown and yellow wheat rust. Chandra Shekhar Azad University of Agricultural Sciences and Technology, Kanpur, created Multiline KML 7406 (Bithoor) with a Kalyan Sona background. Wheat KSML 3 multiline has rust resistance genes. In 1982, the Crew multiline was launched in the United States against stripe rust of wheat.

Conclusion:

The level of the disease infestation will be reduced in a multiline and its mixture. The control of disease will increase with the time and with the exchange of increasing propagates of pathogens. Super-races formation process will not necessarily evolve and if it is going, it will be proceeding very slowly. There might be increase in frequency at the beginning of the season of crop as pathogen genotypes may attack more than one component and then turn down in later season.