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BREENDING PROGRESS REVIEW ON THE TRIFOLIUM REPENS

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Abstract:

White clover (Trifolium repens L.) is a perennial species, it is part of the Fabaceae family, it grows as a creeping, branched perennial plant. It is widespread in a wide range of climates in the temperate and subtropical regions of the northern and southern hemispheres. Sustainable agricultural practices include the use of white clover or legumes to supply nitrogen to the soil in a crop rotation strategy to limit the use of agrochemicals. The species is frequently used as a cover crop, which serves as manure and is also included in mixtures with other forage plants in cattle feed. Several studies have reported the suppressive effects of white clover on weed and disease pressure or unexplained failure of overseeded grasses in clover-dominated pastures.

The polyploidy and genetic diversity of white clover have made it difficult to make rapid progress in genetic and genomic studies. Molecular genetic studies have been carried out for the last quarter of a century, and at the initial stage, segregation, and diversity analyses were performed with restriction fragment length polymorphism (RFLP) markers, random amplified polymorphic DNA (RAPD), and markers by amplified fragment length polymorphism (AFLP). The first linkage map was constructed with 78 SSR and 57 AFLP markers using an F2 mapping population cross between parental inbred lines. A linkage map suggesting homeologous pairing of linkage groups was subsequently reported, which consisted of 493 SSR loci on 16 homeologous linkage groups of 1144 cM.

• Introduction

Trifolium repens is also known as white clover, creeping clover, honeysuckle clover, or ladino clover. It is native to the Mediterranean Sea and during the early Miocene, 16-23 million years ago, it spread to Western Asia and Europe through animal and human migration. The cultivation of white clover started about 400 years ago, it is currently considered a naturalized plant, it tends to acclimatize in the temperate region of the globe where the annual precipitation is over 750 mm.

The distribution of the species is wide due to its nature of edaphic tolerance, it grows on soils that vary from acidic to calcareous (Ahmad and Zeb, 2020). It grows well where the annual precipitation is in the range of 31-191 cm, the average temperature is between 4.3°-21.8 °C, and the soil pH is between 4.5-8.2 (Springer and Aiken, 2015). White clover is mainly grown in perennial pastures together with other forage plants, using direct grazing or mechanically harvested in hay and silage. However, flowering always reduces the number of axillary buds growing into branch stolons and leaf production, producing a sharp drop in nutritional value and digestibility.

Therefore, delaying the flowering period and extending the vegetative growth period of T. repens will greatly improve yield and forage quality.

Seed yield is an important criterion for determining the commercial acceptability of new varieties. Often, the seed production capacity of a forage variety is tested only at the final stages of its development, but the most effective strategy would be to select and select plants for seed yield at an early stage of reproduction (Jahufer and Gawler, 2000).

• Results and discussions

Trifolium repens is a heterotetraploid rich in various nutrients and mineral elements, it has high nutritional, ecological, genetic, and medicinal values. The forage has good palatability for herbivorous animals due to its high carbohydrate and protein content, being used as feed for ruminants in many parts of the world. It has excellent growth when mixed with forages from the Gramineae family, and plays an integral role in intensive grazing in terms of animal performance and forage production, thus suggesting its important role in the stable development of the grassland ecosystem.

Substantial segregation bias was observed for both mapped and unmapped loci, with a bias toward heterozygous types and a preponderance of skewed markers on certain LGs. This observation, and the high degree of residual heterozygosity within the inbred parental genotypes, suggests reduced individual fitness due to the loss of heterosis which is a major effect for white clover and which will limit the applicability of F2 or backcross mapping strategies for this species (Jones et al., 2003).

Breeding objectives past and future

Increase in fodder production and adaptability to climate change. Genetic control of the growth performance of white clover is of great importance to dairy industries due to increasing soil salinity problems (Wang et al., 2010).

However, at present, only the variety called Aberlasting, derived from interspecific hybridization, has been commercially released, and adequate seed production remains a major obstacle to the successful commercialization of Trifolium hybrids (Caradus et al., 2023).

Conclusions:

The importance of white clover as a pasture legume has led to major genetic advances in ecophysiology research, germplasm conservation, and white clover improvement.

Acknowledgement:

White clover breeding programs have sought to increase dry matter yield, improve forage quality and persistence, or a combination of these. Selections for improved drought tolerance have been marginally successful.