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Advancements in Rice Science to the Developing Countries

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Introduction

Human practice and rice production are on current debate. Rapid change in land use pattern, human selection, rapid modernization of agricultural practice, economics of rice production are major issues and extensive research is required to optimize these issues to find out their control, impact and operative response. Since its origin, the spread of rice cultivation is extensive and is now being grown wherever water resource is adequate and under suitable agro-climate [1]. Varietal diversification, speed of evolution, natural crossing, genetic diversity, cultivars choice of local genetics is important consideration. Research is needed their role in ecological adaptation with respect to economic parent. Breeding under water- logged and lowland conditions, tops sequence of field, accumulation of toxic substances due to ill-drained field condition, low tilling, premature lodging, deep water areas, bioclimatology are special situation for rice cultivation. Research can be motivated on these issues because limited information is now available in current literature. Rice is the staple food for about a third of the global population with most of the world's supply coming mainly from South and Southeast Asia. As a result of the Green Revolution this region has become heavily dependent on groundwater irrigation for economic development and food security. This entire region is the world's largest user of groundwater, accounting for withdrawal of several million litres every day. In many parts of this region, the groundwater happens to be contaminated with arsenic and large-scale groundwater development has been used for irrigation-based farming practices. This has led to high deposition of as in top soils and preferential bioaccumulation of the as in several crops notably rice [2]. The effects of the massive redistribution of As on sustainable agricultural production In many Asian countries and the impacts on food security at the local and global levels have been unappreciated and urgently urge for research to unearth several issues such as potentiality of crops particularly rice for As exposure, bioavailability of As depending on several factors e.g. role of soil pore water, color, grain size, genotype, Varity, cultivation practice, summer vs. winter cultivation etc. Research is also needed to develop potentiality of staple diet (rice) as an alternative of as exposure variety. The importance of several soil-plant systems regarding bioaccumulation of as is another topic of current research to find out the global role of such systems. The origin of rice has an important issue and an archaeological rice sample can be studied by dating with radiocarbon. A detailed study is required about the origin, antiquity and spread of rice cultivation with in the country, state and cross – boundary approach. The epicentre of rice antiquity to be given to focus Origin and Cytogenetics so that comprehensive knowledge will be appeared. It has long been recognized that the wild species closely related to O.sativa and their global distribution is important to make new species ancestral for optimize yield [3]. The distinctions are not clear cut, as intermediates have been arising as a result of natural crossings.

Discussion

Species has to be distinguished from its close relative depending seasonal, grain size, longer anthers, plant and panicle characters. Research is needed to explain the current complex situation by the introduction of hybrid system. The advancement of climate change and rice production is another critical issue and several factors to be considered for research inputs such as physiological stresses, seasonal forms and variation, deceleration of production in different agro-climatic zones, climate stress vs. human selection. A special focus will be helpful to study the advancement of climate change during the Pleistocene Period and current scenario. In a rice improvement programme, it is the Germ plasm, which virtually determines the success and nature of end product. The development of superior rice population involved the intelligent use of available genetic variability both indigenous as well as exotic to cater the need of various farming situations of rice. The grain yield is the primary trait targeted for improvement of rice productivity in both favourable and unfavourable environments from its present level. Knowledge on the genetic architecture of genotypes is necessary to formulate efficient breeding methodology [4]. It is essential to find out the relative magnitude of additive and non-addictive genetic variances, heritability and genetic gain with regard to the characters of concern to the breeder. The systematic breeding programme involves the steps like creating genetic variability, practicing selection and utilization of selected genotypes to evolve promising varieties. The large spectrum genetic variability in segregating populations depends on the level of genetic diversity among genotypes offer better scope for selection. Heritability and genetic advance are other important selection parameters. The estimates of heritability help the plant breeder in determining the character for which selection would be rewarding. The breeders are interested in selection of superior genotypes based on their phenotypic expression. The major function of heritability estimates is to provide information on transmission of characters from the parents to the progeny [5]. Heritability estimates can anticipate improvement by selection of useful characters. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. Therefore, estimates of GCV, PCV, heritability and genetic advance will play an important role in exploiting future research projections of rice improvement. Although characters like flowering, plant height and biological yield hill-1 had high heritability values, they exhibited less genetic advance as percentage of mean, suggesting preponderance of non-addictive gene action in the inheritance of these traits. Mehetre also reported high heritability with low genetic advance for flowering [6]. The characters having high heritability coupled with high genetic advance as percentage of mean indicated the broad sense of additive gene effects in its inheritance and such characters could be improved by selection.

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Whereas low heritability and low genetic advance shows non-additive gene action. However, characters showing high values of heritability coupled with moderate genetic advance viz. percent pollen fertility, grain yield hill-1, harvest index and number of filled grains panicle-1 suggest that selection for the improvement of these characters may be re warding. It also indicates greater role of non-additive gene action in their inheritance suggesting heterosis breeding could be useful for improving these traits. A large proportion of world's population depends on rice for food. Rice contributes to human nutrition calories consumed worldwide. Asia, with millions of yielding more than millions of tonnes, is the main world rice producer accounting total [7]. Europe contribution is limited to million tonnes that result from a cultivated area of about acres. Rice is grown in a wide range of environments characterized by different temperatures, climates and soil-water conditions. It can grow in areas ill-suited for other crops. Nonetheless, adverse environmental conditions seriously threaten rice production causing enormous losses in large areas of the world, even in the most productive irrigated lands. In fact, abiotic and biotic stresses often prevent the achievements of optimum yields, limiting the attainance of the maximun potential of growth. Abiotic stresses, such as drought, high salinity, high or low temperatures, flooding, high light, ozone, low nutrient availability, mineral deficiency, heavy metals, pollutants, wind and mechanical injury, all represent a serious threat to sustainable rice production. Among them, drought and high salinity are the two main causes of yield losses worldwide [8]. Biotic stresses, brought about by biological agents such as viruses, bacteria, fungi, nematodes, insects or herbivores, further reduce rice productivity. Blast disease, provoked by the fungus Magnaporthe oryzae, and bacterial blight, caused by the bacterium Xanthomonas oryzae pv. oryzae, represent two of the most serious and destructive diseases of this crop. Over the past decades, the mechanisms of response to abiotic and biotic stresses in rice have been extensively investigated at physiological, biochemical, genetic and molecular levels [9]. More recently, the availability of high-throughput techniques has offered unprecedented opportunities for the dissection of the complex signalling pathways and the regulatory gene networks involved in such responses, providing new tools for the targeted manipulation of stress-related traits. In fact, platforms allow for whole genome transcriptome analyses, proteomic analyses and metabolomic analyses, providing a comprehensive profile of all metabolites accumulated under any given condition. Metabolites may play a dual role since they may act either as effectors or as signalling molecules capable of modulating gene expression. Approaches applied to stress in rice should carefully consider the dynamics of the response by monitoring the different time points during stress exposure. In this way, dataset integration can provide a more informative picture of the whole response, not just single snapshots. Integrative data are actually starting to accumulate in rice as reported in the following few examples [10]. By a combined transcripts and proteomics approach, the role of jasmonic acid in controlling RNA and protein expression in rice shoots and roots has been dissected. A combined transcripts and metabolomics analysis performed on rice response to bacterial blight has identified some corresponding changes, although a coherent interpretation of the global results is still far to be attained.

Conclusion

In conclusion, we can state that studying stress response in rice remains a vivid, rewarding and stimulating argument of research, with important consequences at both environmental and social levels in consideration of the on-going global climate change and the predicted increase of the world population.

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Conflict of Interest

None

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