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Production of Stress Tolerant Rice

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Introduction

Rapid progress has been made in developing flooding tolerant rice varieties and continuous attempts are being made to disseminate these varieties to farmers in unfavourable rice growing ecologies. Incorporating submergence tolerance into high yielding popular rice cultivars has been recognized to be the most effective approach to alleviate the effects of submergence. Recently, strategies have been focusing for replacing other popular mega varieties with their stress tolerant versions in the suitable target areas. The rationale of this work is that farmers are already well adapted with the popular varieties and introduction of their stress tolerant versions will not entail to inform them about new specifications and cultivation practices. This would lead to easy adoption and popularization of in initial stage and would also provide the track for totally new varieties to be accepted by farmers [1]. Development of salt tolerant rice varieties can serve as the most economical and effective approach to enhance crop production in salinity affected ecologies. Although many salinity tolerant landraces are under cultivation, the fact is that these cultivars have poor agronomic features with low yield potential. These landraces are being used as potential donors to enhance the salinity tolerance in otherwise sensitive but popular rice cultivars. A landrace has been observed to show relatively better salt tolerance and thus used as highly potential donor. In this landrace, governing salinity tolerance at vegetative stage has been identified on chromosome. Similarly, it is being exploited as a potential donor for salinity tolerance. This genotype possesses enhanced degree of seedling stage salinity tolerance, besides being photoperiod insensitive and flowers earlier than the original ones [2]. Using marker assisted backcross breeding, Saltol and others has been intro-gressed in some popular rice varieties to enhance their cultivation in salinity affected areas. Salinity tolerance is a multifaceted phenomenon and requires the combination of independent and/or interdependent mechanisms. The tolerance at one stage is usually independent of the tolerance at other stage. Likewise, salinity tolerance is a polygenic trait independently and/or inter-dependently controlled. Eleven for salt tolerance were identified on Chromosomes from the population derived by crossing Nona Bokra and Koshihikari. Similarly, seedling stage salt tolerance in cultivar Changbai were identified on chromosomes. The immense need is to develop rice varieties with multiple QTLs governing salt tolerance at different growth stages. Enhancing heat tolerance in rice has been one of the major breeding objectives throughout the tropics especially in view of the on-going climatic change. Wide variation for heat tolerance has been observed among the different cultivars of rice [3]. Among the heat tolerant varieties involves Indica cultivars viz., IR24 and IR36; Japonica cultivars viz., Akitakomachi and Koshihikari; and an aus landrace, Nagina. Landraces which are more adapted to the local environmental conditions could be the potential sources for heat tolerance. The aus indica landrace has been identified as one of the most heat tolerant accessions and it has been used as a check variety for most of heat tolerance studies in rice.

Discussion

Heat tolerance can be intro-gressed into other varieties for developing the heat tolerant climate resilient rice cultivars. Several major and minors for high temperature tolerance along with their linked markers have been identified in rice. However, the constraints for developing superior genotypes with heat tolerance are that the trait is governed by small effects or several epistatics [4]. Pyramiding several QTLs in the same genetic background using large populations through marker-assisted breeding or genomic selection can be employed to overcome the problem. High throughput phenol-typing and genotyping approaches such as genome wide association studies and genotyping by sequencing can be exploited to tap all the available diversity contributing towards heat tolerance. With the advancements in genome editing, the crop improvement for heat tolerance can be accelerated. The development of cold tolerant rice cultivars is one of the most effective and economical approaches to enhance rice production especially in the areas prone to cold stress. A wide spectrum of variations in cold tolerance has been observed amongst the rice genotypes, reflecting the differences in places of their origin and breeding history. Japonica varieties are usually distributed in high elevated ecologies and show better cold tolerance compared to indica. They are thus used as donors in breeding programs for the improvement of cold tolerance [5]. Cold tolerance is a complex trait, highly influenced by environmental factors and controlled by different genes at different growth stages. Considerable efforts have been made for evaluation and mappings associated with cold tolerance in rice. Some genes governing cold tolerance at the vegetative stage have been identified. Similarly, various low-temperature germin-ability-associated have been identified in different populations. Jiang identified putative governing low-temperature germin-ability on chromosomes. Fewer have been identified for cold tolerance at bud stage than at the germination stage. Most of the stress-prone areas are inhabited by socio-economically disadvantaged farmers possessing marginal to small land holdings with unstable yields. Thus, abiotic stresses affect the unprivileged farmers disproportionately. The extent of abiotic stresses induced damages is drastic and irreparable. The reason being that the crops are usually in an active growth stage and farmers already have incurred substantial investments in the form of inputs. Moreover, farmers growing rice in stress prone areas are risk-averse and therefore reluctant to use costly farm inputs, thereby resulting in further decline of yield. The cultivation encourages the farmers to invest more on inputs due to reduced risks of crop failure. This results in an increase in farm output during all the years, irrespective of the severity of stresses. Besides, they represent an important adaptation to climate change that can increase farm productivity and ensure production from the affected land. This leads to optimism that the

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problems associated with climate change can be dealt partly through the development, dissemination and of adaption of resilient varieties [6]. Advantage, affordability, awareness and availability are the main factors responsible for the adoption of any technology. They reveal better performance during stress as well as non-stress conditions and thus show distinct advantage. Moreover, no special expenditure needs to be incurred by farmers while adopting, thus there are no issues of affordability. The adoption of stress tolerant varieties has not reached to its potential, predominantly due to the lack of information and non-availability of seeds with farmers. Informational inefficiencies act as main barrier for the adoption. Increasing awareness about the worth of new varieties is the first and foremost step for their rapid and large-scale adoption. Proper awareness enhances seed multiplication and marketing by creating the sufficient and continuous demand for quality seed. The relative advantage in performance of rice varieties in farmers' fields may result in their rapid adoption, for the reason that most the farmers procure seeds from neighbours and relatives, and better performing cultivars disseminate fast through exchange once farmers are well informed about their benefits [7]. The informal seed system through exchange and sharing amongst farmers has been an effective strategy for both pre- and post-release dissemination. This process is smooth but slow and highly fragile due to its sensitivity to natural disasters, unpredictable weather changes, and limited capacity of farmers to produce and retain good quality seeds for exchange. Regular access to seeds of climate resilient rice varieties is important to address such challenges and the supply of seeds through business channels is the only sustainable way forward [8]. Using a panel data survey from rice farmers conducted in four provinces in China, this article investigates the contribution of adopting stress tolerant variety in response to extreme climate to the rice yield loss reduction. Different from the current literature, we assume Hicksian neutral technology of adopting stress-tolerant variety and employ an IV regression to estimate the average treatment effect on rice yield for adopting stress-tolerant variety by taking into consideration of the endogeneity of adoption behaviour [9]. The results of adoption behaviours reveal that farmers' adoption decision of stress tolerant rice variety mainly depends on the severity of climate extremes, local access to public service on new variety, the number of labour forces, and the cost of inputs. The former three factors could incentivize farmers to adopt the new variety, while the cost of inputs for rice production discourages farmers to adopt. More importantly, we find that farmers who adopted the stress tolerant variety increased rice yield in regression [10]. It suggests that adopting stress tolerant variety could generally increase rice production and contribute to the reduction in rice yield loss. The estimation results also indicate that the possible benefit of adopting stress tolerant variety for non-adopters is much smaller than those adopters. Adoption of new variety demands more agricultural labour forces, more new knowledge, more intensive management and higher seed costs, thus the benefit might not overcome the learning costs and adoption costs.

Conclusion

Therefore, further expansion of the stress tolerant rice variety calls for more government action on extension services. In addition, we find that the output elasticity for all physical inputs are very small in terms of point estimation, and none is statistically significant. It implies that further increases of these inputs would have very small effect on expansion of rice output, as the rice yield in China has reached very high level in the world. In addition, no significant interaction terms between adoption choice and physical inputs implies that our assumption of Hicksian neutral technology is valid.

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Conflict of Interest

None

References

1. Ferichani M, Prasetya DA (2017)System of rice intensification increases rice productivity on saline soil. Paddy Water Environ EU 15: 649-657.
2. Siwar C, Idris NDM, Muhammad Y, Morshed G (2014)Issues and Challenges Facing Rice Production and Food Security in the Granary Areas in the East Coast Economic Region (ECER), Malaysia. TJASR MY 7: 711-722.
3. Hanif N (2017)The Involvement of Extension Agent in Planning, Implementing and Monitoring Activities Base on the Rice Check at Iada Peka, Pahang. PSASIR MY: 1-43.
4. Atanassova B (1999)Functional male sterility (ps-2) in tomato (Lycopesicon esculentum Mill.) and its application in breeding and hybrid seed production. Euphytica EU 107: 13-21.
5. Staub JE (2008)Intellectual Property Rights, Genetic Markers, and Hybrid Seed Production .J new Seed USA 1: 39-64.
6. Martion CS, Farina WM (2015) Honeybee floral constancy and pollination efficiency in sunflower (Helianthus annuus) crops for hybrid seed production. Apidologie EU 47: 161-170.
7. Ravi D, Prakash A (2012)Production and applications of artificial seeds: a review. Int Res J Biological Sci USA 1: 74-78.
8. Sharma Y, Sharmal SN (2005)Chemical hybridizing agents (CHA)–a tool for hybrid seed production–a review. Agric Rev IND 26: 114-123.
9. Drechsel P, Dongus S (2009)Dynamics and sustainability of urban agriculture: Examples from sub-Saharan Africa. Sustain Sci UN 5: 69-78.
10. Smit J, Nasr J (1992)Urban agriculture for sustainable cities: using wastes and idle land and water bodies as resources. Environ Urban US 4: 141-152.