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Functional Genomics of Rice

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Abstract

Water requirement of rice is higher than that of any other crop of a similar duration. Tilling to flowering stage is the most critical stages, therefore enough water ensured from panicle initiation stage to flowering. Application of small quantities of water at short intervals to keep the soil saturated is more effective and economical than flooding for long interval. Weeds pose a serious problem in upland rice than in transplanted rice. Infestation of weeds in rice field found to reduce yield in direct sown and transplanted rice. Hand weeding is the most effective method of weed control in both rice culture but very costly due to high labour cost.

Keywords: Requirement of rice; Weeds control; Agricultural condition; Ruderal species; Sown rice

Introduction

Integrated approach of mechanical, cultural and chemical weeds control is the most effective method. Many practices such as closer spacing, selection of taller varieties, crop rotation and use of weed free seeds etc. help in reducing intensity of weeds infestation in rice field [1]. Use of herbicides is labour saving; take less time, more convenient and less expensive method. Harvesting of crop is done when panicles turn yellow or golden in colour. In case of delay, crop will be lost due to shattering, lodging and damage by insects, birds and rats. Right stage of harvesting is attained when panicles have about ripened spikelet. At the time of harvest the upper portion of the spikelet should be straw coloured, and rain moisture content. Crop can be harvested by hand using sickle or reaper or mini combine harvester. Threshing is done either by trampling by bullock or striking bundles on wooden raised platform, pedal thresher. Paddy can be stored indoors in jute bags, or in, bamboo, or in a metal bins. Hermetic bags and cocoons are also available in the market which can ensure the seed quality in storage. The main principle behind storage is to keep seed safe from insects, pest and sprouting and to maintain it biological health for future use [2]. Celphos tablets or dry neem leaves can be used in storage. Rice the moisture content must be at or for safe storage. Weed populations in areas free from disturbance by tillage regimes or herbicides are considered to be relatively stable, in terms of density and species diversity. However, when ecosystems are disturbed or cultivated as under most agricultural condition. Weed populations change, colonizing bare ground, a response typical of ruderal species. Connell and Slatyer consider inler-alia, that contemporary ecological concept has shifted from the early Clementsian idea of a successional series of species moving inexorably towards a stable state incorporating at least three possible pathways.

Discussion

Due to the continuous nature of disturbance by cultivation, tillage operations, herbicide applications, and other agronomic practices, the appropriate model of succession for a weedy agricultural land lies somewhere between the tolerance model applied to secondary succession and that which Connell and Slatyer denoted as inhibition model. The former model in the absence of further disturbance depicts an old-field succession. Invariably, the net effect of agricultural operations is to maintain vegetation at an early successional stage suitably adapted to competitive ruderals. The weed flora in a rice field is markedly influenced by the method of rice culture [3]. Continuous rice cultivation with unchanged cultural system encourages the build-up of weeds adapted to that system. Although weed problems in rice vary from one ecosystem to another, it is widely recognized that weeds cause more damage than other pests, in particular in upland rice compared with all the other ecosystems in which rice is grown. Noxiousness is a measure of both the undesirability of a weed and the difficulty in controlling it [4]. There are weed species in genera with few families known to be problematic in rice. Among them are E. crus-galli, L. chinensis, I. rugosnm, E. colona and weedy rice. In tropical Asian countries, the moderately warm to high temperature and high humidity are conducive to year-round luxuriant weed growth. Among them are Echinochloa crus-galli complex, E. colona, E.oryzicola, Leplochloa chinensis and I. rugosum. These weeds have become dominant and competitive in DSR in the tropics. The advent of direct seeding and the continuous usage of phenoxy-group of herbicides and inadequate water supply, inter-alia, are factors perceived to be responsible for the shift in weed species dominance and diversity in rice ecosystems. Echinochloa crus-galli complex, along with other Echinochloa aggregates, Leplochloa chinensis, Ischaemum rugosnm and Paspalum dislichum, which were not so prevalent and dominant in Malaysian rice fields in 1970s, became widespread in the 1990s. In many areas of the Philippines, E. crus-galli is fairly common in wet-seeded rice. Other weeds reported to be of importance included P. distichum, I. rugosnm, M. vagina/is and Sphenoclea zeylanica. Echinochloa crus-galli, a cosmopolitan and noxious species in many tropical crops, is considered to be the major weed of rice. It has been reported as a weed in countries and different crops. The ecological requirements of E. crus-galli are very similar to those of rice and certain varieties of the former are very difficult to distinguish from one another in the early stages of growth. Barnyardgrass is a C. plant which grows very well under wet conditions [5]. In addition, C, weeds display higher net photosynthetic rates, water and N use efficiency than do the C, plants of which rice is one under all light regimes. Under shade, therefore, C4 weeds have a competitive advantage over rice. Echinochloa crus-galli complex consist of three subspecies namely E. crus-galli var. crus-galli, E. crus-galli var. formosensis and E. crus-galli var. praticola. Both E. crus-galli

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complex and E. oryzi-cola resemble the rice plant and their growth is restricted to rice fields. These species are important weeds in Southeast and East Asia. Another important grass weed in tropical rice areas is Ischaemum rugosum. It was reported to be a major weed of partially irrigated and rain-fed lowland rice in Thailand, Sri Lanka, Philippines, Malaysia and India. It is an annual grass and a native of tropical Asia. It is easily recognized by its spiral awns and by the prominent transverse ridges on the lower glume of the spikelet. Echinochloa colona is also an important weed species in rice in the Philippines and India. It is an annual grass and a native of India. The weed is an excellent competitor and if the rice crop is badly managed the crop may be forced out by this weedy plant. It has a prostrate growth habit in early seedling stages. An emerging threat in DSR in tropical Asia is weedy rice [6]. Weedy rice can be defined as rice plants which occur spontaneously as weeds within or around rice fields. Moody reported that weedy forms of rice occurred in Malaysia, Philippines and Vietnam. In Malaysia weedy rice is locally known as padi angin. Padi angin, with many morphological variants, shows a high degree of deciduousness before being harvested. Baki recognized at least few variants of weedy rice species in Malaysia. Many theories have been put forward on origin of weedy rice. Moody lists 6 possible ways in which weedy rice can evolve, outcrossing with wild or shattering rice, segregants of a heterogeneous cultivar, degeneration of the cultivar due to continuous use, seed mixtures, volunteers from the previous crop and mutation [7]. The seeds of noxious weeds often enter rice fields with crop seeds. They may be transferred from neighbouring fields through farm machineries and on the feet, fur, feathers and skin of rodents, birds and larger animals, including human. Weed succession and distribution patterns in rice fields are dynamic in nature and are governed by spatio-temporal elements, and the agronomic practices being employed. As such, species dominance and their patterns of distribution varied considerably [8]. A few species could claim the status of ubiquity in rice areas of Peninsular Malaysia, i. e. Monochoria vagina/is, Ludwigia adscendens, Fimbristylis miliacea, Scirpus grossus, Limnocharis flava, Leersia hexandra, Cyperus haspans and L. hyssopifolia. With the dissemination of direct seeding in the 1990s, there was a dramatic shift in the weed flora in the rice fields. Azmi reported that E. crus-galli was the most dominant weed in DSR. Other important weeds in rice included F. miliacea, Limnocharis flava and M. vagina/are. Ho recorded a meaningful shift in species dominance among rice weeds in the Muda granary, arguably brought about by the change in rice culture from the dominantly transplanting rice culture to direct seeding [9]. Rapid rise of E. crus-galli as the most dominant weed species in DSR in Kemubu rice area, Malaysia was found to be related to the adoption of DSR by Azmi. They considered that perennial monocots constituted the greatest threat to adoption of reduced tillage systems. Furthermore, reduced tillage tends the favour rhizome and stolon bearing perennials over annuals. Similar findings of more diverse populations of perennial weeds were reported in reduced tillage regimes. In his work, Pollard & Cussans noted the high prevalence of perennials in non-tillage compared to systems that included pre-plant tillage. Studies in the impact of agronomic practices on weed communities carried out by Derksen, did not reveal any increase in the association of perennial and annual grasses with zero tillage [10]. They also ob- served that changes in weed communities were markedly influenced by time and space rather than tillage systems operating, indicating fluctuation rather than directional or consistent changes in community composition. Sagar gave a schematic representation of the factors that may control the size and to a certain extent species succession in an agricultural area. Weed populations in rice are influenced by the crop establishment method.

Conclusion

Baki and Azmi have reported that more broadleaved weeds grow in association with transplanted rice while more grassy weeds with wet seeded rice. Moody and Drost reported that weed problems will be less prevalent when wet seeded or transplanted rice is grown as the first crop than dry-seeded rice.

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Conflict of Interest

None

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