A case study: Weed identification and control measure in moisture stress conditions under red-lateritic belt of West Bengal

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Weeds are plants that are undesirable to human activity at a particular time and place, and therefore, weeds will always be associated with human endeavour. Weeds are not only important in agriculture but are also a great nuisance in forestry, pastures and grasslands, wastelands, public amenity areas, aquatic bodies etc. They also affect biodiversity, environment and health of humans and livestock. Unlike other pests, weeds are ubiquitous and affect almost all the crops. Weeds deplete soil moisture and reduce soil water avail- ability in the crop root zone (Saha *et al.*, 2023). Therefore, water stress in agricultural systems depends on crop–weed interactions and the degree to which crops and weeds extract soil water under water-stressed conditions. Among all the biotic stresses, weeds cause the greatest losses amounting to nearly one third Mukherjee, 2021). As the scope for horizontal increase has little possibility in view of the limited area available for cultivation, the only alternative feasible is the vertical increase which can be achieved with better genotypes and providing farmer-friendly input technology. The improved weed management is one such technology which has a tremendous potential in providing a plausible solution to meet the growing demand of food grains, pulses, oilseeds and other crops by the ever-increasing population. Though weeds existed from time immemorial, the modem agriculture, characterized mainly by large scale adoption of dwarf HYV s and hybrids, increased use of irrigation and fertilizers, reduced tillage and globalization of agriculture has severely intensified manifold the weed problems. Low soil moisture increases the competition for water between the weed and the crop, therefore, weed control is even more important when water is scare. Generally, when moisture is limiting, there may be fewer and less vigorous weeds and weed emergence may be delayed until rainfall occurs. Drought tolerant weeds such as thistle a field bind weed develop extensive root systems early and take advantage of limited water, making them more competitive and germination leading to decreased weed abundance. The resulting water-stress conditions negatively affect seed germination, plant growth and development, and seed production of crop particularly in red-latertic belt. For example, water stress can impede or delay germination by constraining water needed for seed hydration and/or during progressive germination and emergence phases. Similarly, water stress impacts plant growth and development, primarily by limiting photosynthetic capacity via stomatal closure and by reducing photosynthate assimilation via limited expansion of leaves.

Table 1: Weed diversity under different cropping system of moisture stress situation

Weed diversity under moisture stress condition		
Broadleave weeds	**Grasses**	***Sedges***
Chenopodium murale, Chenopodium album, Alternanthera sessilis, Cleome viscosa, Euphorbia hirta, Heliotropium indicum, Convolvulus arvensis, Trianthema portulacastrum,Synedrella nodiflora, Euphorbia spp. Argemone maxicana, Tribullus terrestris and *Cirsium arvense*	*Cynodon dactylon, Dactyloctenium aegyptium, Digitaria sanguinalis, Echinochloa colona* and *Eleusine indica*	*Cyperus rotundus, Cyperus esculentus* and *Fimbristylis miliacea*

As per our observation, during last two year 2022-23 at Jhargram block of West Bengal revealed that, our crop field in rainfed are mostly three, rice (*Oryza sativa* L.), oilseeds, wheat (*Triticum species*), corn (*Zea mays* L.),and was followed in importance by a variety of legume species, particularly chickpea (Cicer arietinum L.), dry bean (*Phaseolus vulgaris* L.), lentil (*Lens culinaris* L.), feld pea (*Pisum sativum* L.), broad bean (*Vicia faber* L.), pigeonpea (*Cajanus cajan* L.), cowpea (*Vigna unguiculata* L.) and peanuts (*Arachis hypogea* L.). These are mostly infested several moisture stress weeds (Table 1). Weeds respond under moisture stress by thickening their leaf cuticle and reducing

their vegetative growth. Some of important dominant weeds found in rainfed areas as follows:

Paspalum scrobiculaturum - common with direct seeded rice field

Phillanthus amarus - Common weeds with different crop sequence

Tridex Procumbens in association with maize

Infested of direct seeded rice with BLWs

Infestation of groundnut field with sedges

Synedrella nodiflora common weed in different crop sequence

These weeds are able to survive even under extreme drought conditions. Some of special adaptations were observed in these weeds i.e. presence of extensive root system, waxy substance on the leave, thick and fleshy leaves and presence of awn. These weeds can be controlled effectively by intervention of variable option of weed control and weed management measures.

Weed management

Weed ''management'' implies more than weed ''control'' and is an important choice of terms and direction. The ''ruthless fight to the last weed'' is part of the weed control paradigm, whereas a weed management paradigm suggests greater consideration of thresholds, critical periods, environment, and possibly even social outcomes, before weed management methods are imposed. This can be achieved based on suitability of particular technology in appropriate farming system model. Various crop establishment measures significantly reduce weed flora distribution pattern and this become suitable to specific crop (Mukherjee, 219). Therefore, the next logical step is to integrate multiple weed management strategies into Integrated Weed Management systems.

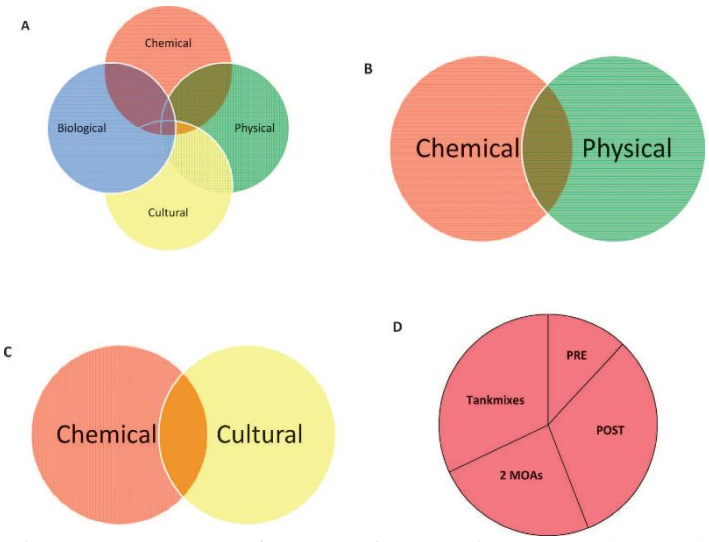

Figure 1. Some forms of true integrated weed management (IWM) (A–C) in contrast to integrated herbicide management (D).

(Source: Harker and Donovan, 2013)

The complete weed control through adoption of any single method is highly doubtful. The concept of integrated weed management is more suitable for dry land agriculture to save the cost and get efficient control of weeds. Normal weeding or inter-culture operation required to control weeds are not possible under certain situation (Mukherjee, 2021). Further, initial weeds population which is very small in growth is sometimes ignored for some time to make enough growth. Such very early growth can be effectively controlled by pre or post emergence application of herbicide in cereals as well as legumes. The dose of the herbicide required for spraying varies depending primarily upon the type of herbicide, type and intensity of weed infestation, stage of weed and crop, weed control efficiency. Soil mulching and intercropping with suitable crop become effective to restrict weed density. Other cultural methods like application of high seed rate, pure seed, sowing in rows, high density, stale seed bed preparation, use of well decomposed manures and application of fertilizers in rows, following drip irrigation etc. are effective to reduce the weed competition. Soil solarization can be an effective method for weed control in nursery of various crop.

Many factors including temperature, rainfall, wind, soil type and stage of development of weed species influence our weed management options

particularly under rainfed or moisture stress situations. Establishment and maintenance of a weed control programme. is an essential part of effective way under moisture stress condition of Jhargram (West Bengal) like blocks, which completely depend on rain-fall situation. Well-designed need-based programme, rely on a combination of methods and materials, rather than a single strategy should be adapted to combat the vigorous weed problem in crop field.

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