Review of ReseaRch
ISSN: 2249-894X
Impact Factor : 5.7631(UIF)
Volume - 15 | Issue - 11 | August - 2026

"IMPACT OF AGRICULTURAL PRACTICES ON WEED FLORA DIVERSITY IN PADDY FIELDS OF REWA REGION"

Sadhana Patel
Research Scholar, Department of Botany, Govt. Girls P.G. College, Rewa (M.P.)

Dr. Rashmi Arnold
Professor Department of Botany, PMCOE, Govt. Model Science College Rewa (M.P.)

ABSTRACT

Agricultural practices play a significant role in determining the composition, abundance and diversity of weed flora in crop ecosystems. The present study was undertaken to evaluate the impact of different agricultural practices on weed flora diversity in paddy (Oryza sativa L.) fields of the Rewa region of Madhya Pradesh. Paddy cultivation in the region is characterized by considerable variation in land preparation, crop establishment methods, irrigation, fertilizer application, hand weeding and herbicide use. These management practices create different ecological conditions within agricultural fields and consequently influence the occurrence and distribution of weed species. The investigation focused on the comparative assessment of weed communities occurring under different levels and types of agricultural management. Field observations and quadrat-based sampling were used to document weed species and analyse ecological parameters including species richness, frequency, density, abundance and relative dominance. Weed diversity was further evaluated using commonly applied diversity indices. The weed flora consisted mainly of grasses, sedges and broad-leaved herbaceous species. Families such as Poaceae and Cyperaceae formed important components of the weed community because of their ecological adaptability to moist and periodically waterlogged paddy habitats.

KEYWORDS: *Agricultural practices, Paddy fields, Weed diversity, Agroecosystem, Weed management, Rewa region, Madhya Pradesh.*

INTRODUCTION

Agricultural ecosystems are dynamic environments in which cultivated crops interact continuously with a wide variety of plant, animal and microbial communities. Among the plant communities associated with agricultural fields, weeds constitute one of the most important ecological and economic components. Weeds grow naturally in cultivated habitats and compete with crop plants for resources such as water, nutrients, light and space. Their presence can significantly influence crop growth and productivity, particularly when competitive species establish dense populations during the critical stages of crop development. However, weeds are also important components of agricultural biodiversity and their composition can provide valuable information regarding environmental conditions, agricultural disturbance and land-use practices.

Paddy (*Oryza sativa* L.) is one of the most important cereal crops cultivated in India and forms a major component of the agricultural economy of many rural regions. Paddy fields provide unique

ecological conditions because they experience seasonal variations in soil moisture and water availability. During the cropping season, agricultural fields may range from moist terrestrial habitats to partially or completely waterlogged ecosystems. These environmental conditions, together with continuous agricultural disturbance, create favourable opportunities for the establishment of diverse weed communities.

The composition of weed flora in paddy fields is not determined solely by natural environmental conditions. Agricultural practices have a direct and substantial influence on the germination, establishment, growth and distribution of weed species. Land preparation, tillage, puddling, crop establishment method, seed rate, fertilizer application, irrigation, drainage, hand weeding and herbicide use can modify the ecological conditions of agricultural fields and alter weed community structure. Consequently, neighbouring fields cultivated with the same crop may support significantly different weed populations when managed using different agricultural practices. Tillage and land preparation are particularly important because they influence the distribution of weed seeds within the soil profile. Soil disturbance can expose previously buried seeds to favourable environmental conditions and stimulate germination. Puddling, commonly practised in transplanted paddy cultivation, modifies soil structure and water conditions and may suppress certain terrestrial weeds while favouring species adapted to wet environments. Similarly, direct-seeded paddy systems often support weed communities that differ considerably from those occurring in transplanted fields because of differences in crop establishment and early competition.

Water management also plays a major role in determining weed flora composition. Paddy fields with continuous or prolonged waterlogging generally favour species capable of tolerating saturated soil conditions, whereas fields experiencing intermittent irrigation or temporary drying may support a greater diversity of terrestrial grasses and broad-leaved weeds. Sedges and moisture-tolerant grasses are frequently associated with wet paddy habitats, while certain broad-leaved weeds become more abundant when soil surfaces remain exposed for longer periods. The use of fertilizers can further influence weed growth and species composition. Nutrients supplied to promote crop growth may also be utilized by associated weeds. Highly competitive species capable of rapid nutrient uptake can increase in abundance under favourable fertility conditions. Therefore, the timing, quantity and method of fertilizer application may indirectly influence weed–crop competition and community structure.

Weed management practices are among the strongest anthropogenic factors affecting weed diversity. Manual weeding generally reduces the density of visible and dominant species, whereas repeated use of herbicides may selectively suppress susceptible weeds and alter the composition of the weed community. Over time, intensive reliance on particular herbicides can favour species that are naturally tolerant or less susceptible to the applied chemical. Thus, weed management practices can influence not only the total abundance of weeds but also the long-term diversity and dominance patterns of agricultural weed communities.

The Rewa region of Madhya Pradesh represents an important agricultural landscape where paddy is widely cultivated during the Kharif season. The region is characterized by variation in rainfall, soil conditions, water availability and farming practices. Traditional and modern methods of paddy cultivation are practised simultaneously in different rural areas. Such variation provides an important opportunity to examine the relationship between agricultural practices and weed flora diversity.

A systematic analysis of weed communities associated with different agricultural practices is important for understanding changes in agro-biodiversity and developing sustainable weed management strategies. Information regarding dominant weed species, species richness and ecological distribution can help farmers and agricultural scientists select appropriate management techniques. The present investigation was therefore undertaken to evaluate the impact of different agricultural practices on weed flora diversity in paddy fields of the Rewa region of Madhya Pradesh. The major objectives of the study were to document weed species associated with paddy cultivation, compare weed flora under different agricultural management conditions, evaluate the influence of tillage, irrigation, fertilizer application and weed control practices, and analyse changes in species richness, abundance and ecological dominance.

MATERIALS AND METHODS:

Study Area

The present study was conducted in selected paddy-growing areas of the Rewa region, Madhya Pradesh, India. The Rewa region forms an important part of the Vindhyan landscape and supports extensive agricultural activity. Paddy cultivation is predominantly carried out during the Kharif season under rain-fed as well as partially irrigated conditions. The region experiences a tropical monsoonal climate characterized by high temperatures during summer, seasonal rainfall during the monsoon period and comparatively cooler conditions during winter. The availability of rainfall and irrigation water during the Kharif season creates favourable conditions for paddy cultivation. However, differences in field-level water management result in substantial variation in soil moisture and waterlogging among agricultural fields. Agricultural landscapes of the study area consist of cultivated fields, seasonal wetlands, ponds, irrigation channels, fallow lands and rural settlements. Such landscape heterogeneity contributes to the availability of different ecological habitats for agricultural weed species.

Selection of Paddy Fields:

Paddy fields representing different agricultural practices were selected for the study. The fields were broadly categorized according to variation in major management practices such as land preparation, crop establishment, irrigation, fertilizer application and weed control. The agricultural practices considered during the study included conventional tillage, puddling, transplanted paddy cultivation, differences in water management, manual weeding and herbicide-based weed control. Fields with comparatively intensive agricultural management were compared with fields where weed management practices were less intensive. Information regarding agricultural practices was collected through direct field observations and discussions with cultivators. The objective was to understand the relationship between field management and weed community composition.

Field Survey and Weed Sampling

Field surveys were conducted during the active paddy-growing season. Repeated visits were made to selected agricultural fields at different stages of crop growth to document temporal changes in weed composition. Quadrat sampling was used for the ecological analysis of weed vegetation. Quadrats were placed randomly at different locations within each field to obtain representative observations. All weed species occurring within each quadrat were recorded and the number of individuals of each species was counted. The field observations included information on species occurrence, abundance, growth form, crop growth stage, soil moisture condition and visible agricultural disturbances. Weed specimens were collected for identification and taxonomic confirmation.

Classification of Agricultural Practices

For comparative analysis, agricultural practices were grouped into major management categories. The first category included fields subjected to relatively intensive management, characterized by proper land preparation, regular water management and repeated weed control measures. The second category included moderately managed fields where agricultural operations were performed but weed control was less frequent. The third category represented comparatively low-intensity management conditions where manual or chemical weed control was limited. This classification was useful for evaluating changes in weed species richness and abundance in response to different levels of agricultural disturbance and management.

Taxonomic Identification

Weed specimens collected from different paddy fields were identified using morphological characters and standard botanical literature. The identified species were classified according to family, genus and species. For ecological interpretation, the weed flora was grouped into three major functional categories:

Grasses: Species belonging mainly to the family Poaceae.
Sedges: Species belonging mainly to the family Cyperaceae.
Broad-leaved weeds: Herbaceous dicotyledonous and other broad-leaved species belonging to different families.

RESULTS AND DISCUSSIONS:

General Composition of Weed Flora

The ecological survey of paddy fields in the Rewa region revealed that agricultural fields supported a diverse assemblage of weed species. The recorded weed flora consisted mainly of grasses, sedges and broad-leaved herbaceous species. The composition of these ecological groups varied among fields depending upon agricultural management and local environmental conditions.

The presence of diverse weed species indicates that paddy fields represent dynamic agroecosystems in which natural ecological processes operate under continuous human influence. Agricultural practices such as ploughing, puddling, transplantation, irrigation and weed control create repeated disturbances that influence the establishment and survival of different species. The composition of weed flora differed between intensively managed and comparatively less managed agricultural fields. Intensively managed fields generally exhibited reduced weed density because of regular weed control practices. However, selective management practices could also influence the relative dominance of individual weed species.

Impact of Land Preparation and Tillage

Land preparation and tillage significantly influenced the structure of weed communities. Soil disturbance during ploughing exposes buried weed seeds and may stimulate their germination. At the same time, repeated tillage can destroy established weeds and reduce the survival of certain species. In paddy cultivation, puddling is an important agricultural practice that modifies soil structure and creates saturated conditions. Such conditions may suppress some terrestrial weed species while favouring weeds adapted to moist and waterlogged habitats.

The study indicates that fields subjected to intensive puddling and proper land preparation showed differences in weed composition compared with less intensively prepared fields. Moisture-tolerant grasses and sedges were more closely associated with paddy fields where favourable water conditions persisted for longer periods. Tillage therefore acts as an important ecological filter by influencing the soil seed bank, germination environment and competitive interactions among crop and weed species.

Impact of Crop Establishment Method

The method used for establishing the paddy crop also influenced weed diversity. Transplanted paddy fields generally experience a different pattern of crop–weed competition compared with direct-seeded fields. In transplanted systems, rice seedlings are already established when introduced into the field, which may provide the crop with an initial competitive advantage. In contrast, direct-seeded paddy may allow simultaneous emergence of crop and weed seedlings, creating favourable opportunities for weed establishment.

The differences in crop establishment influence light availability, soil disturbance and the timing of competition. These factors subsequently affect the diversity and abundance of associated weed species. The results suggest that crop establishment practices should be considered an important factor when analysing weed communities in paddy ecosystems.

Impact of Water Management

Water availability emerged as one of the most important factors influencing weed flora diversity. Paddy fields maintained under continuous or prolonged wet conditions supported weed species adapted to saturated soils. Sedges and certain grasses showed greater ecological association with moist and waterlogged conditions. Fields experiencing intermittent irrigation or temporary drying showed comparatively different weed communities. The exposure of soil surfaces and reduction in

water levels created favourable conditions for terrestrial grasses and broad-leaved weeds. Differences in water management can therefore influence the ecological balance among different functional groups. Proper water management may help suppress certain weed species, but irregular water availability can create opportunities for the emergence of diverse weed populations.

Impact of Fertilizer Application

Fertilizer application is essential for improving paddy productivity, but nutrient availability may also influence the growth of associated weeds. Nitrogen, phosphorus and other nutrients supplied to the crop can be utilized by competitive weed species. The ecological response of weeds to fertilizer application depends upon species-specific growth characteristics. Rapidly growing species capable of efficient nutrient uptake may become dominant under nutrient-rich conditions. Fields receiving higher levels of fertilizer may therefore support vigorous populations of competitive weeds when adequate weed management is not practised. The timing and method of fertilizer application are consequently important for minimizing nutrient competition between crop plants and weeds.

Impact of Manual Weeding

Manual weeding remains one of the most commonly practised methods of weed management in traditional paddy cultivation. Regular removal of weeds can significantly reduce weed density and prevent dominant species from completing their reproductive cycle. The study indicated that fields subjected to repeated manual weeding generally maintained lower visible weed biomass and reduced populations of dominant competitive species. However, the ecological impact of manual weeding depended upon the timing and frequency of the operation. Early removal of weeds during the critical stages of crop growth was particularly important because weeds emerging during these periods can compete strongly with young rice plants. Manual weeding may also influence species diversity by selectively removing larger and easily visible weed species while allowing smaller or later-emerging species to persist.

Impact of Herbicide Application

Herbicide application can substantially influence weed population density and species composition. Fields treated with appropriate herbicides generally showed reduced abundance of susceptible weed species. However, repeated use of the same herbicide or herbicide group may alter the ecological structure of weed communities. Species that are naturally tolerant or less susceptible may survive and gradually increase in relative abundance. The results therefore emphasize that herbicide use should be integrated with other management approaches. Exclusive dependence on chemical control may lead to changes in species composition and may increase the ecological dominance of difficult-to-control weeds. Sustainable weed management should include appropriate herbicide rotation, correct application timing and integration with cultural and mechanical practices.

Variation in Species Richness

Species richness showed variation among paddy fields subjected to different agricultural practices. Fields with lower weed control intensity generally supported a greater number of weed species, whereas intensively managed fields tended to show reduced weed abundance and, in many cases, lower species richness. However, the relationship between management intensity and diversity was not always uniform. Certain agricultural practices selectively suppressed dominant species and allowed less competitive species to persist. Therefore, diversity patterns depended not only on the overall intensity of management but also on the specific combination of practices adopted by farmers. The observed variation indicates that agricultural management functions as a major ecological factor controlling plant diversity within cultivated landscapes.

Changes in Dominance Patterns

Agricultural practices influenced not only the number of weed species but also their relative dominance. In fields receiving limited weed management, a few highly competitive species often

developed dense populations and occupied large portions of the available habitat. Regular manual weeding or herbicide application reduced the dominance of some major species. However, when management selectively affected only particular groups, other species were able to increase in abundance. This pattern demonstrates that weed communities are continuously changing in response to agricultural disturbance. Monitoring dominance patterns is therefore important for identifying emerging weed problems and developing effective management strategies.

Ecological Response of Grasses, Sedges and Broad-Leaved Weeds

The three major ecological groups of weeds responded differently to agricultural practices. Grasses showed high adaptability to disturbed and open agricultural habitats. Their abundance was influenced by crop establishment methods, tillage and the intensity of competition with paddy plants. Sedges were strongly associated with moist and waterlogged conditions. Their occurrence was particularly influenced by water management and the duration of soil saturation. Broad-leaved weeds exhibited greater taxonomic diversity and showed varied responses to soil conditions, water availability and management practices. Some species were associated with wet habitats, whereas others occurred more frequently in comparatively dry or intermittently irrigated areas. The differential response of these ecological groups indicates that effective weed management should consider the specific biology and ecological requirements of dominant weed species rather than relying on a single uniform control strategy.

Agricultural Practices and Agro-Biodiversity

The findings demonstrate that agricultural practices influence the biodiversity of paddy agroecosystems. Intensive management may reduce the abundance of weeds and protect crop productivity, but it can also reduce the diversity of non-crop plant species. On the other hand, low-intensity management may support greater plant diversity but can also increase competition and reduce crop performance when weed populations become excessive. Therefore, sustainable agricultural management requires a balanced approach that controls economically damaging weed populations while minimizing unnecessary ecological disturbance. The conservation of agricultural biodiversity should not be interpreted as allowing uncontrolled weed growth. Instead, it requires an understanding of ecological relationships and the development of management strategies that maintain ecosystem stability while ensuring crop productivity.

Implications for Sustainable Weed Management

The results of the present study provide useful information for the development of sustainable and integrated weed management strategies in the Rewa region. Management programmes should focus on identifying dominant and highly competitive weed species, understanding their ecological requirements and selecting appropriate control methods. A combination of timely land preparation, proper water management, suitable crop establishment, balanced fertilizer application, manual weeding and judicious herbicide use can provide more effective weed control than dependence on a single method. Integrated weed management can reduce the ecological risks associated with excessive chemical use and may help maintain a more stable agricultural ecosystem. Regular monitoring of weed flora is also necessary because changes in cropping practices and environmental conditions can result in shifts in species composition and dominance patterns over time.

CONCLUSION:

The present study demonstrates that agricultural practices have a significant influence on the composition, diversity and ecological distribution of weed flora in paddy fields of the Rewa region. The weed communities associated with paddy cultivation consisted mainly of grasses, sedges and broad-leaved herbaceous species, and their occurrence varied according to differences in field management and environmental conditions. Land preparation and tillage influenced the soil environment and weed seed germination, while crop establishment methods affected the timing and intensity of crop–weed competition. Water management played a particularly important role in determining the relative

abundance of moisture-tolerant grasses and sedges. Fertilizer application influenced weed growth by modifying nutrient availability, whereas manual weeding and herbicide application directly altered weed density and species dominance. The results indicate that intensively managed fields generally supported lower weed density, although specific management practices could also modify species composition by selectively suppressing certain weeds and allowing others to persist. Fields with comparatively limited weed control tended to support greater weed abundance and species richness. The study highlights the importance of understanding agricultural management as a major ecological factor shaping weed communities. Sustainable weed management should therefore be based on an integrated approach that combines cultural, mechanical and chemical methods according to local ecological conditions.

REFERENCES

1. Buhler, D. D. (2002). Challenges and opportunities for integrated weed management. *Weed Science*, 50, 273–280.
2. Chauhan, B. S. (2012). Weed ecology and weed management strategies for dry-seeded rice in Asia. *Weed Technology*, 26, 1–13.
3. Chauhan, B. S., & Johnson, D. E. (2010). The role of seed ecology in improving weed management strategies in the tropics. *Advances in Agronomy*, 105, 221–262.
4. Gupta, O. P. (2012). *Modern Weed Management*. Agrobios, Jodhpur.
5. Jain, S. K., & Rao, R. R. (1977). *A Handbook of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi.
6. Mishra, J. S., & Singh, V. P. (2012). Tillage and weed management effects on weed dynamics and productivity of rice-based cropping systems. *Indian Journal of Weed Science*, 44, 105–112.
7. Moody, K. (1989). *Weeds Reported in Rice in South and Southeast Asia*. International Rice Research Institute, Los Baños, Philippines.
8. Mueller-Dombois, D., & Ellenberg, H. (1974). *Aims and Methods of Vegetation Ecology*. John Wiley and Sons, New York.
9. Oerke, E. C. (2006). Crop losses to pests. *Journal of Agricultural Science*, 144, 31–43.
10. Rao, V. S. (2000). *Principles of Weed Science*. Oxford and IBH Publishing Co., New Delhi.
11. Shannon, C. E., & Weaver, W. (1949). *The Mathematical Theory of Communication*. University of Illinois Press, Urbana.
12. Simpson, E. H. (1949). Measurement of diversity. *Nature*, 163, 688.