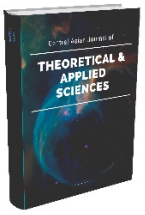


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# Integrated Weed Management in Rice Wheat Cropping System

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***Abstract:*** Integrated Weed Management (IWM) means integrating multiple weed control tactics into a single weed management program, optimizing control of a particular weed problem. The past several decades have seen simplified weed control practices that rely heavily on a few popular herbicides. However, the rapid spread of herbicide-resistant weeds has required farmers to incorporate alternative weed management approaches. While many farmers are incorporating different herbicides, this is likely to have only short-term success. Using non-herbicide approaches in combination with multiple, effective sites of action is needed for long-term success. It might be better to first discuss why weed control is necessary. Weeds negatively impact crop yields, interfere with many crop production practices, and weed seeds can contaminate grain. Based on national research, corn and soybean yield can be reduced by approximately 50% without effective weed control.

Herbicide application is the main weed control strategy used. Reliance on this one method has led to the development of herbicide-resistant weeds. There are a limited number of herbicides available to use and cases of herbicide resistance are rapidly increasing in the US. As a result, herbicides are in need of extra help to continue to ensure adequate weed control.

IWM tactics span a wide range of options and complexity. Many IWM tactics can be integrated without substantial change to current management programs, while others require more extensive planning and implementation. Some options that are easier to implement include: equipment cleaning, timely scouting, altering herbicide tank mixes; while more extensive options include: changing crop rotation, cover cropping, changing tillage practices, and harvest time weed seed control.

The goal of IWM is to incorporate different methods of weed management into a combined effort to control weeds. Just as using the same herbicide again and again can lead to resistance, reliance on any one of the methods below over time can reduce its efficacy against weeds. Two major factors to consider when developing an IWM plan are (1) target weed species and (2) time, resources, and capabilities necessary to implement these tactics.

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While it is wise to be a good steward of herbicide technology, through the use of PRE and POST herbicide applications or tank mixes, IWM requires the use of tactics beyond herbicides. For example, using these herbicide application practices along with a winter cover crop or harvest weed seed control (HWSC) and prevention methods would be considered IWM.

***Keywords:*** *Integrated weed management, rice, wheat, cropping, system, methods, application, multiple, control, tactics.*

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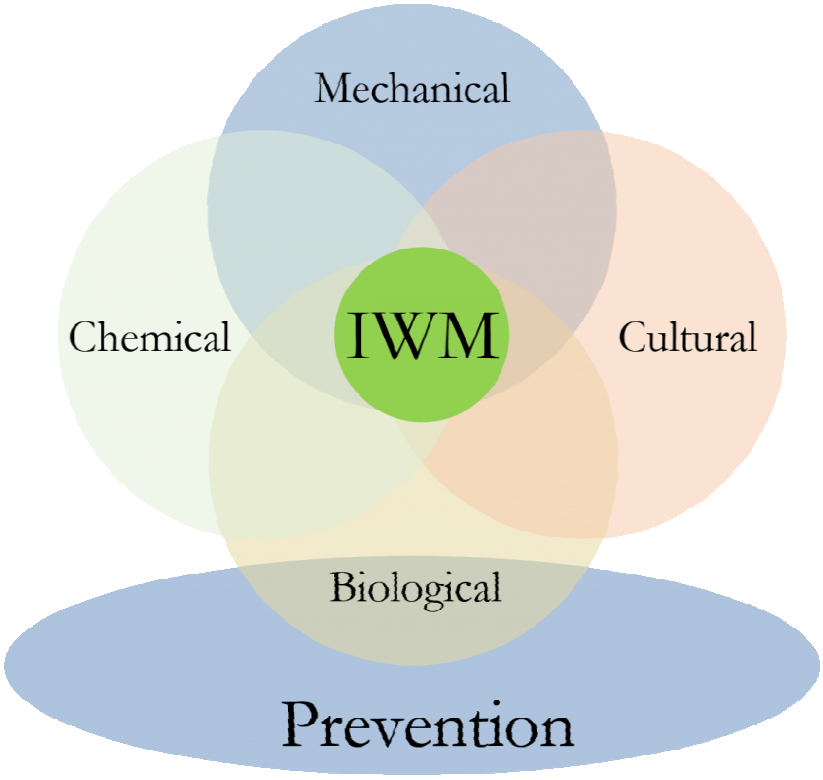
## INTRODUCTION

Weeds compete with productive crops of rice and wheat or pasture, they can be poisonous, distasteful, produce burrs, thorns or otherwise interfere with the use and management of desirable plants by contaminating harvests or interfering with livestock.




Weeds compete with crops for space, nutrients, water and light. Smaller, slower growing seedlings are more susceptible than those that are larger and more vigorous. Onions are one of the most vulnerable, because they are slow to germinate and produce slender, upright stems .By contrast broad beans produce large seedlings and suffer far fewer effects other than during periods of water shortage at the crucial time when the pods are filling out .Transplanted crops raised in sterile soil or potting compost gain a head start over germinating weeds.[1,2]

Annual and biennial weeds such as chickweed, annual meadow grass, shepherd's purse, groundsel, fat hen, cleaver, speedwell and hairy bittercress propagate themselves by seeding. Many produce huge numbers of seed several times a season, some all year round. Groundsel can produce 1000 seed, and can



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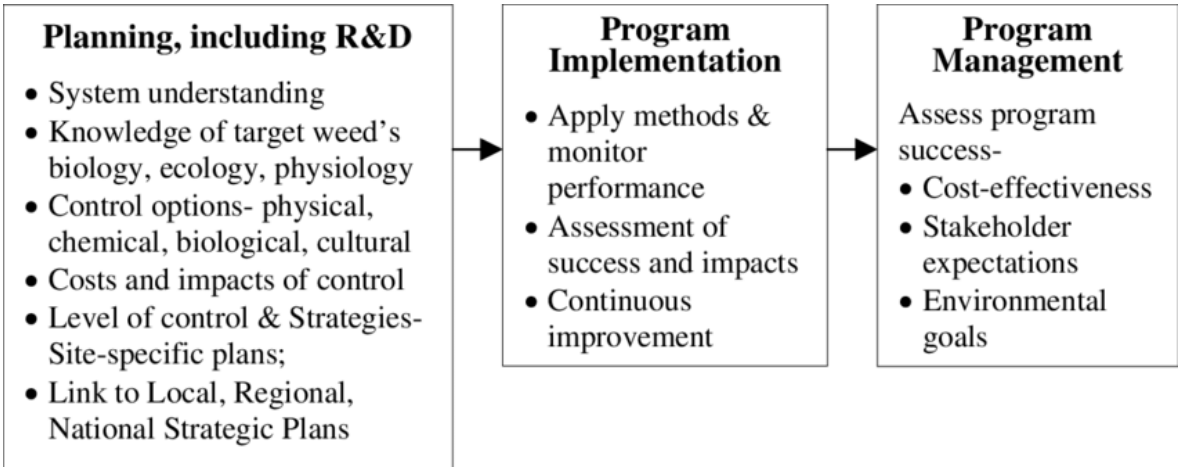
continue right through a mild winter, whilst Scentless Mayweed produces over 30,000 seeds per plant. Not all of these will germinate at once, but over several seasons, lying dormant in the soil sometimes for years until exposed to light. Poppy seed can survive 80–100 years, dock 50 or more. There can be many thousands of seeds in a square foot or square metre of ground, thus any soil disturbance will produce a flush of fresh weed seedlings[3,4]




The most persistent perennials spread by underground creeping rhizomes that can regrow from a tiny fragment. These include couch grass, bindweed, ground elder, nettles, rosebay willow herb, Japanese knotweed, horsetail and bracken, as well as creeping thistle, whose tap roots can put out lateral roots. Other perennials put out runners that spread along the soil surface. As they creep they set down roots, enabling them to colonise bare ground with great rapidity. These include creeping buttercup and ground ivy. Yet another group of perennials propagate by stolons- stems that arch back into the ground to reroot. The most familiar of these is the bramble.

Integrated Weed control plans for rice and wheat typically consist of many methods which are divided into biological, chemical, cultural, and physical/mechanical control.

In a domestic gardens, methods of weed control include covering an area of ground with a material that creates an unsuitable environment for weed growth, known as a *weed mat*. For example, several layers of wet newspaper prevent light from reaching plants beneath, which kills them.

In the case of black plastic, the greenhouse effect kills the plants. Although the black plastic sheet is effective at preventing weeds that it covers, it is difficult to achieve complete coverage. Eradicating persistent perennials may require the sheets to be left in place for at least two seasons.[5,6]

Some plants are said to produce root exudates that suppress herbaceous weeds. *Tagetes minuta* is claimed to be effective against couch and ground elder,[4] whilst a border of comfrey is also said to act as a barrier against the invasion of some weeds including couch. A 5–10 centimetres (2.0–3.9 in) layer of wood chip mulch prevents some weeds from sprouting.

Gravel can serve as an inorganic mulch.

Irrigation is sometimes used as a weed control measure such as in the case of paddy fields to kill any plant other than the water-tolerant rice crop.

Many gardeners still remove weeds by manually pulling them out of the ground, making sure to include the roots that would otherwise allow some to re-sprout.[7,8]



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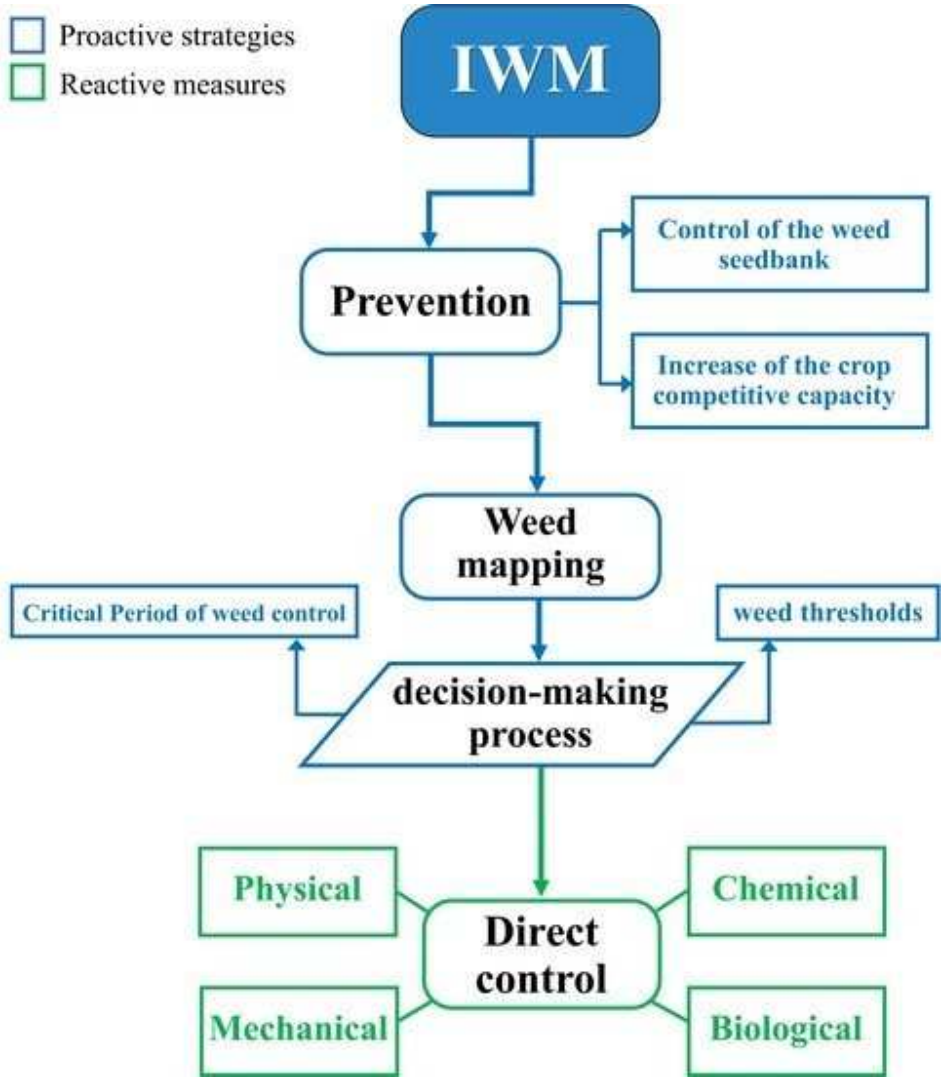


Hoeing off weed leaves and stems as soon as they appear can eventually weaken and kill perennials, although this will require persistence in the case of plants such as bindweed. Nettle infestations can be tackled by cutting back at least three times a year, repeated over a three-year period. Bramble can be dealt with in a similar way.

A highly successful, mostly manual, removal programme of weed control for wheat crop

Ploughing includes tilling of soil, intercultural ploughing and summer ploughing. Ploughing uproots weeds, causing them to die. Summer ploughing also helps in killing pests.

Mechanical tilling with various types of cultivators can remove weeds around crop plants at various points in the growing process.

An Aquamog can be used to remove weeds covering a body of water

Several thermal methods can control weeds.[9,10]

Flame weeding uses a flame several centimetres/inches away from the weeds to singe them, giving them a sudden and severe heating.The goal of flame weeding is not necessarily burning the plant, but rather causing a lethal wilting by denaturing proteins in the weed. Similarly, hot air weeders can heat up the seeds to the point of destroying them. Flame weeders can be combined with techniques such as stale



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seedbeds (preparing and watering the seedbed early, then killing the nascent crop of weeds that springs up from it, then sowing the crop seeds) and pre-emergence flaming (doing a flame pass against weed seedlings after the sowing of the crop seeds but before those seedlings emerge from the soil—a span of time that can be days or weeks).

Hot foam causes the cell walls to rupture, killing the plant. Weed burners heat up soil quickly and destroy superficial parts of the plants. Weed seeds are often heat resistant and even react with an increase of growth on dry heat.

Since the 19th century soil steam sterilization has been used to clean weeds completely from soil. Several research results confirm the high effectiveness of humid heat against weeds and its seeds. Soil solarization in some circumstances is very effective at eliminating weeds while maintaining grass. Planted grass of rice and wheat tends to have a higher heat/humidity tolerance than unwanted weeds. [11]

## DISCUSSION

Another manual technique in IWM is the ‘stale seed bed’, which involves cultivating the soil, then leaving it fallow for a week or so. When the initial weeds sprout, the grower lightly hoes them away before planting the desired crop. However, even a freshly cleared bed is susceptible to airborne seed from elsewhere, as well as seed carried by passing animals on their fur, or from imported manure. Buried drip irrigation involves burying drip tape in the subsurface near the planting bed, thereby limiting weeds access to water while also allowing crops to obtain moisture. It is most effective during dry periods. Rotating crops with ones that kill weeds by choking them out, such as hemp, *Mucuna pruriens*, and other crops, can be a very effective method of weed control. It is a way to avoid the use of herbicides, and to gain the benefits of crop rotation. Another method of IWM is a biological weed control regiment can consist of biological control agents, bioherbicides, use of grazing animals, and protection of natural predators. Post-dispersal, weed seed predators, like ground beetles and small vertebrates, can substantially contribute to the weed regulation by removing weed seeds from the soil surface and thus reduce seed bank size. Several studies provided evidence for the role of invertebrates to the biological control of weeds. Companies using goats to control and eradicate leafy spurge, knapweed, and other toxic weeds[12]



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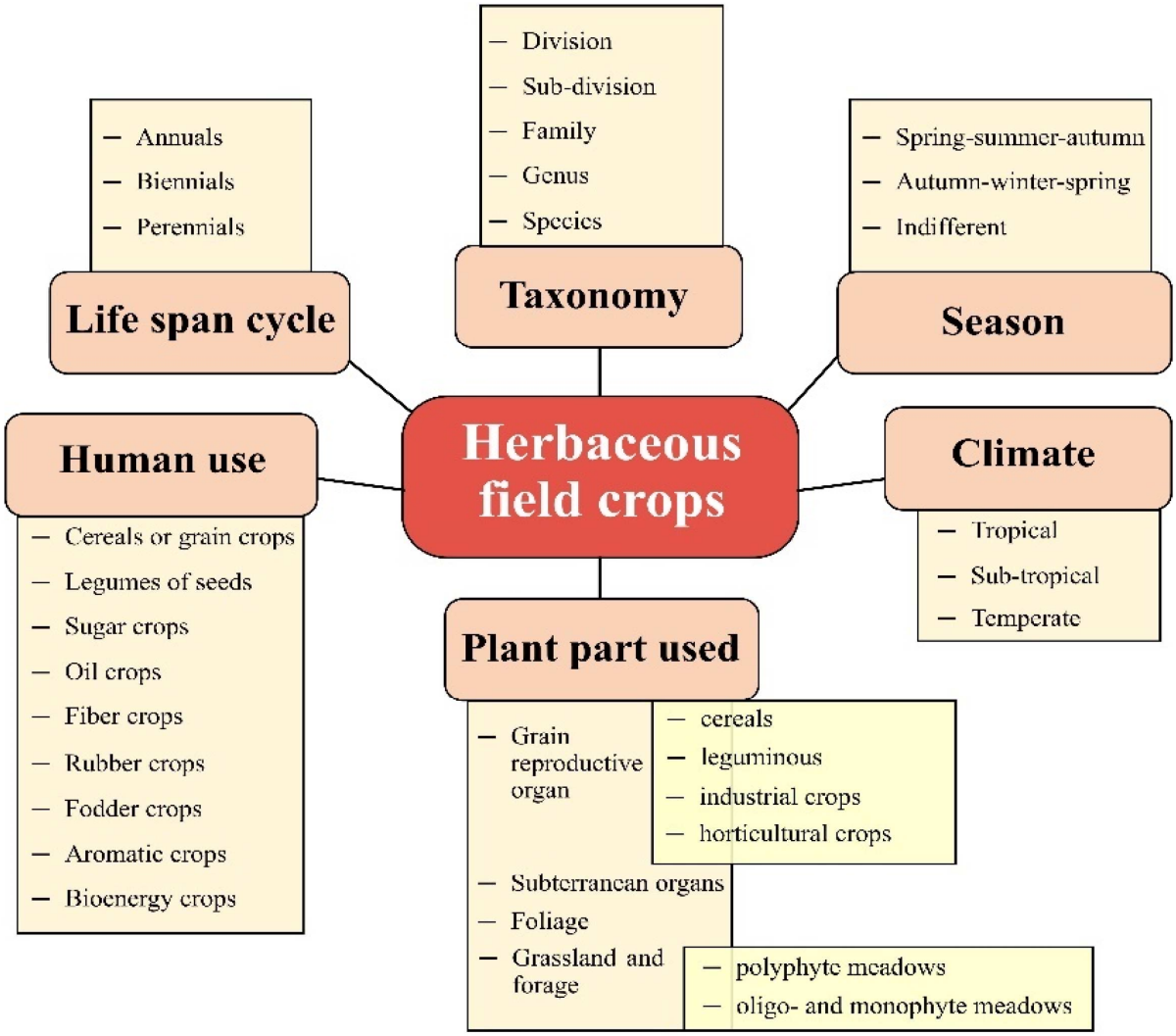


**Chemical methods in IWM**

The above described methods of weed control use no or very limited chemical inputs. They are preferred by organic gardeners or organic farmers.

However weed control can also be achieved by the use of herbicides. Selective herbicides kill certain targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often based on plant hormones. Herbicides are generally classified as follows:

- Contact herbicides destroy only plant tissue that contacts the herbicide. Generally, these are the fastest-acting herbicides. They are ineffective on perennial plants that can re-grow from roots or tubers.
- Systemic herbicides are foliar-applied and move through the plant where they destroy a greater amount of tissue. Glyphosate is currently the most used systemic herbicide.
- Soil-borne herbicides are applied to the soil and are taken up by the roots of the target plant.
- Pre-emergent herbicides are applied to the soil and prevent germination or early growth of weed seeds.



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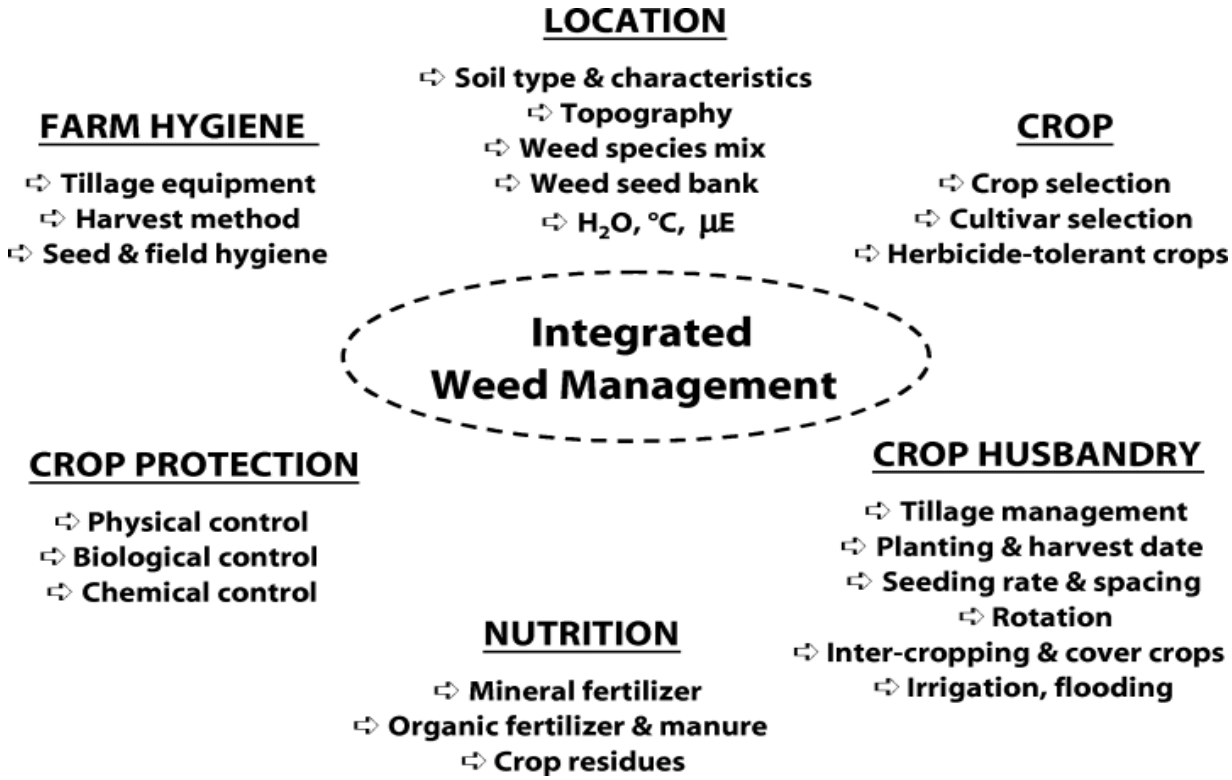
In agriculture large scale and systematic procedures are usually required, often by machines, such as large liquid herbicide 'floater' sprayers, or aerial application.[13]

**RESULTS**

Resistance occurs when a target plant species does not respond to a chemical that previously used to control it.




It has been argued that over-reliance on herbicides along with the absence of any preventive or other cultural practices resulted in the evolution and spread of herbicide-resistant weeds. Increasing number of herbicide resistance weeds around the world has led to warnings on reducing frequent use of herbicides with the same or similar modes of action and combining chemicals with other weed control methods; this is called 'Integrated Weed Management'. Herbicide resistance recently became a critical problem as many Australian sheep farmers switched to exclusively growing wheat in their pastures in the 1970s. In wheat fields, introduced varieties of ryegrass, while good for grazing sheep, are intense competitors with wheat. Ryegrasses produce so many seeds that, if left unchecked, they can completely choke a field. Herbicides provided excellent control, while reducing soil disrupting because of less need to plough. Within little more than a decade, ryegrass and other weeds began to develop resistance. Ryegrass populations were large, and had substantial genetic diversity, because farmers had planted many varieties. Ryegrass is cross-pollinated by wind, so genes shuffle frequently. Farmers sprayed inexpensive Hoegrass year after year, creating selection pressure, but were diluting the herbicide in order to save money, increasing plants survival. Hoegrass was mostly replaced by a group of herbicides that block acetolactate synthase, again helped by poor application practices. Ryegrass evolved a kind of "cross-resistance" that allowed it to rapidly break down a variety of herbicides. Australian farmers lost four classes of herbicides in only a few years. As of 2013 only two herbicide classes, called Photosystem II and long-chain fatty acid inhibitors, had become the last hope[14]



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## CONCLUSIONS

Pesticide application is also included in IWM refers to the practical way in which pesticides (including herbicides, fungicides, insecticides, or nematode control agents) are delivered to their *biological targets* (*e.g.* pest organism, crop Like Rice And Wheat or other plant). Public concern about the use of pesticides has highlighted the need to make this process as efficient as possible, in order to minimise their release into the environment and human exposure (including operators, bystanders and consumers of produce). The practice of pest management by the rational application of pesticides is supremely multi-disciplinary, combining many aspects of biology and chemistry with: agronomy, engineering, meteorology, socio-economics and public health, together with newer disciplines such as biotechnology and information science. Seed treatments of rice and wheatcan achieve exceptionally high efficiencies, in terms of effective dose-transfer to a crop. Pesticides are applied to the seed prior to planting, in the form of a seed treatment, or coating, to protect against soil-borne risks to the plant; additionally, these coatings can provide supplemental chemicals and nutrients designed to encourage growth. A typical seed coating can include a nutrient layer—containing nitrogen, phosphorus, and potassium, a rhizobial layer—containing symbiotic bacteria and other beneficial microorganisms, and a fungicide (or other chemical) layer to make the seed less vulnerable to pests.[15]

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