

# JOURNAL OF PHARMACEUTICAL SCIENCE AND BIOSCIENTIFIC RESEARCH (JPSBR)

(An International Peer Reviewed Pharmaceutical Journal that Encourages Innovation and Creativities)

# Weed and its Management: A Major Threats to Crop Economy

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#### Article history:

Received 09 July 2016 Revised 27 August 2016 Accepted 30 Sept 2016 Available online 01 Nov 2016

#### Citation:

Patel D. D., Kumbhar B. A. Weed and its Management: A Major Threats to Crop Economy J Pharm Sci Bioscientific Res. 2016. 6(6):453-758

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(www.jpsbr.org)

# INTRODUCTION

Weeds are plants growing where it is not wanted these plants are not propagated intentionally. No matter what definition is used, weeds are plants whose undesirable qualities outweigh their good points, according to man[1, 2]. Our human activities create weed problems since no plant is a "weed" in nature. Though we may try to manipulate nature for our own good, nature is persistent. Through the manipulation process, certain weeds are controlled, while, other more serious weeds may thrive because favorable growing conditions for them also have been meet. Both humans and nature are involved in plant breeding programs. The main difference between the two programs is that man breeds plants for yield, while nature breeds plants for survival.

# **Characteristics of weeds**

Certain features are associated with and allow the existence of weeds. Weeds own one or more of the following:

ABSTRACT:

Weeds are spreading faster and creating serious problems throughout world with increasing population. Change in climate poses further challenge for weed management. Weeds have major environmental, economic and social impacts; triggering damage to natural agricultural lands, waterways, landscapes and coastal areas. The economic loss due to weeds is in thousand billions globally per annum. Many measures and methods are in existence to manage the weeds and their effects. The early detection and eradication is the prevention method and most effective means of weed control. Integrated weed management could be the damage control tool for upcoming years.

**KEY WORDS:** Global face of weed, Invasive weed, impact of weed, economic loss, integrated weed management

- a. rapid population establishment;
- b. abundant seed production;
- c. seed dormancy;
- d. adaptation for spread;
- e. long-term survival of supressed seed;
- f. ability to occupy places disturbed by human activities and
- g. presence of vegetative reproductive structures.



Figure 1 Competition for nutrients between crop and weed root.

Weeds are bothersome in several ways that includes,

- a. they reduce crop yield
- b. interference with yield;
- c. decrease crop quality by polluting the goods;

- d. provide shelter for insects to hibernate or serve as hosts for crop diseases;
- e. excretion of chemical stuffs which are toxic to crop plants (allelopathy), animals, or humans; and
- f. limit the choice of crop rotation sequences and cultural practices.

Weeds are among the most serious threats to natural environment as well as primary production industries. They displace native species, contribute significantly to degradation, and reduce farm and forest land productivity. Weeds represent the biggest threat to our biodiversity after habitat loss along with other Invasive species like animal, pests and diseases if they are not controlled in time. Weed invasions change the balance of ecological communities and natural diversity. These changes threaten the survival of many plants and animals as the weeds compete with native plants for space, nutrients and sunlight. They increase the risk of fire, increase costs to infrastructure maintenance, and reduce the amenity of recreation areas. Some weeds have welldocumented and sometimes serious effects on human health.

# **SPREADING OF WEED**

Weeds are unwanted plants along with intentional plants. They never have been implanted in any field although their existence and prevalence is strong. As per Australia environment department, weeds are spreading faster than they can be controlled in all territories of Australian states. The invasive impact of plants continues to increase with exotic species accounting for about 15% of all flora and The figure is increasing by about 10 species per year [3].

The reasons for such invasive and resistive nature of weeds are natural and extreme conditions like cyclones, droughts and floods further create ideal conditions for weeds to extend their range and invade new areas or outcompete native species in their existing range.

Cyclones have ability to invade weeds as it can move soil through air, flood and damage to innate vegetation communities. For control of weed, care must be taken during movement of soil or plant material as it may spread and if necessary it is very important to minimising the movement of soil or plant material from one area to another. Dry conditions of soil created by drought lengthen the durability of weed seed and acts as banks; and whenever circumstances created for germination it starts consequences of weed problems. Moreover when drought decreases the competitiveness of native vegetation, weeds will have new opportunities for invasion. Flood brings weeds along watercourses to zones that were free of weeds before. The native vegetation or crops can wash away exposes areas of troubled soil. Floods provide chances for new weed invasions by dropping competition from prevailing crop plants.

Since last few decays, humans have played very important role in spreading of weed to the places where certain weeds were never found before. Human transport system that may be road transport, air travelling or sea transport have played important role and made this possible.

In developing country like India that is the seventh largest country in world; is fighting with increasing population rate. Ever since the Green-Revolution, 1960; Indian wheat and rice systems have been playing a critical role in the global food economy. Rice have been supplied to many Asian and African countries along with billions of own people. Taking in mind all exports, government of India in 12th plan period of 2012-2017 has set a growth target of 4% for the agriculture sector. [4] However, growth in agriculture and allied sectors is expected to be only 1.1% in 2014-15, down from 3.7% in 2013-14, due to the impact of low southwest monsoon on both kharif (monsoon: Apr-Oct) and rabi (winter: Nov-Mar) harvests. To meet the demands of growing population and to avoid food imports, crop productivity in India needs to identify the constraints that hinder fanners in achieving high yields.

Weeds are one of the major biological constraints that limit crop productivity. They contend with crops for resources besides being responsible for reducing quantity and quality of agricultural productivity[5, 6 7] despite continuous research and extension efforts made. Estimated that weeds in India reduce crop yields by 31.5% (22.7% in winter and 36.5% in summer and kharif seasons).

# **ECONOMIC IMPACTS**

Globally weeds cost billions every year. In the United States in 1991, the projected average monetary loss caused by weeds with control strategies for 46 crops grown was \$4.1 billion per annum. If herbicides were not used, this loss was estimated to be \$19.6 billion. Losses in field crops accounted for 82% of this total [8] Queensland spent an estimated \$600 million every year as per data

obtain from Department of Agriculture and Fisheries, Government of Queensland in year 2016. The cost of reduced production in the Mulga lands of South West Queensland, caused by the intrusion of woody weeds and the ensuing erosion, is estimated at over \$50 million each year. The estimated annual cost of weeds in winter crops in southern Queensland alone is \$40 million. The economic impacts include, competition with pastures leading to reduced stocking capacity and erosion, toxicity to stock, competition with crops for water and nutrients, increased stock mustering costs, loss of ecotourism values, impacts (of aquatic weeds) on water quality and irrigation, management costs arising from the use of physical, mechanical and chemical control methods. Just 5 weeds - parthenium weed (Parthenium hysterophorus), rubber vine (Cryptostegia grandiflora), prickly acacia (Acacia nilotica), mesquite (Prosopis spp.) and parkinsonia (Parkinsonia aculeata) - cost Queensland more than \$50 million each year in lost production and costs of controll [9]. One Annonymus resource stated loss in economy was 33 % due to weed was the highest than any other pest; among all crop yield loss in rice range from 15-90% in different regions of India. [10].

One kilogram of weeds reduced the yield of rice by 500-900 grams in a Nigerian experiment [11]. Another source estimates that U.S. farmers annually spend \$3.6 billion on chemical weed control and \$2.6 billion for cultural and other methods of control. The total cost of weeds in the United States could approach \$15 to \$20 billion dollars [12]. Also, weed control and other input costs (e.g., seed, fertilizer, other pesticides, fuel) vary with the crop. For example, in the mid-90s, herbicides for soybeans cost \$30/acre or about 47% of the \$63/acre in total purchased input. For corn, the cost was \$32/acre or about 28% of the \$114/acre in total purchased input. And for wheat it was \$6 or about 6% of the total \$96/acre inputs. Several factors help determine the relative costs of herbicides from one crop to another and include the competitive ability of the crop, the weeds present, the contribution of non-chemical control practices, the tillage method, management decisions, and the value of the crop [13].

# **Concepts to Measure the Impacts**

Since weeds are so common, normally their economic impact on crop losses and control costs do not recognize in general. Weeds have the potential to unfavourably alter ecosystem function, reduce primary industry output and profitability, and seriously limit the long-term sustainability of global agricultural and natural resources. These impacts can be measured as the direct financial costs of control (herbicide, etc), losses in production, changes in net money revenue, and changes in welfare.

Preferably the financial impacts of weeds should be measured in terms of variations in costs and benefits to the community as a whole. These changes should include all costs and all benefits to whoever they accrue. The standard economic concepts of this loss are welfare (economic surplus), net revenue and opportunity cost[14].

Welfare includes the net well-being of the entire community, measured as the sum of producers surplus and consumers surplus. The former is the revenue profit to the producer, which is money revenue minus variable money costs. The latter is the net profit to the consumer, which is the amount that the consumer is willing to pay minus the consumer has to pay (that will be according to market price). The Net money profit includes the monetary net revenue from control, or the monetary net cost of an invasion. The Opportunity cost is income that is foregone because of the weed invasion, due to yield losses and changes to lower-profit enterprises for example. These are sometimes called indirect costs, and are sometimes measured as a loss of net income and sometimes as a loss of gross income. Financial costs: the direct money costs of control, including chemicals that are used to kill or inhibit growth of weeds and the cost of labour and vehicles to apply it. They are sometimes called direct costs. The change in welfare, or total economic surplus, is the economist's preferred measure of impact because it values the net benefit from control of weeds, or the net costs of an increase in weeds, to the whole community in ways that capture basic notions of wellbeing. It also nets out the financial costs and opportunity costs.

#### WEED MANAGEMENT

Weed management and weed control are the two different terms. Weed management includes prevention, eradication and control by regulated use, restricting invasion, suppression of growth, prevention of seed production and complete destruction. Thus weed control is one of the aspects of weed management [15].



**Figure 2 Weed Management** 

#### Prevention

Preventative steps are used to stop the spread of weeds. Preventing weeds' introduction is much easier than controlling them after being invasive. Preventative practices include cleaning harvesting equipment and tillage of weed seeds and vegetative structures; usage of certified weed free crop seed; and controlling weeds in around the ditch banks, roadways, along fencerows, around structures, and barnyards.

## **Eradication and Control**

Weed control is the process of limiting infestation of the weed plant so that crops can be grown profitably [16]. The eradication and control methods include cultural, physical/mechanical, biological, and chemical means.

#### Chemical control:

Chemical control involves the use of chemical substances known as weedkillers or herbicides. Herbicides control weed plants either by speeding up, stopping or changing the plant's normal growth patterns; by defoliating the plant (making it drop its leaves); or by desiccating (drying out) the leaves or stems. There are five types of such chemicals (1) Broad spectrum (work on a wide variety of plants), (2) Selective (work on a narrow range of plants), (3) Contact (kill plant tissue at or near the point of its contact), (4) Systemic (can be injected into the plant) and (5) Residual (applied to the soil and work by root uptake).

# Mechanical or physical technique:

These techniques involve tool, machine or by any physical means that either creates hurdles in weed germination and weed survival or destroy weeds. These techniques include hand-pulling, mowing, plowing, hoeing, cultivating, disking and digging. In this method Care should be taken to reduce soil disturbance with crop.

#### **Biological control**

Biological control involves the use of diseases causing pathogens or insects that inversely affect the health of the weed. In this technique only certain weeds are potential candidates, and the rate of failure for past biological control efforts has been fairly high. There have been a few success stories of weed species being managed with insect or disease biocontrol agents. Herbivores such as sheep and goats can provide successful control of some common pasture weeds. Research continues in this area of weed management [17].

## Cultural Method:

Cultural techniques include soil analysis for fertilizer and lime requirement; selection of good crop varieties; plantation of dense crop populations at the proper timing; regular inspection fields for weeds, insects, and diseases and if necessary controlling steps should take on time; and implementing crop rotations system. Crop rotation is a classical technique with a weed suppressing effect, widely adopted in the agricultural practise. It can disturb the regeneration cycle and accumulation of weeds, leading to lower infestation densities of the crop relevant weed species over the years [18]. An reintroduction of cover crops, which have not been used intensively in the last decades, also exhibits unused weed-supressing potential [19].

Composting, ensiling, or feeding weeds or weed-infested crops to livestock can destroy the viability of weed seeds. The heat and/or digestive acids break down the majority of weed seeds. However, some seeds pass through livestock unharmed and can germinate if spread back onto the land [20] (Figure 2). The chart shown in figure 2 can be a tool that not only give importance of weed management but also allows growers, researchers and agronomists to look at the potential long-term effects of changing different parts of the life cycle of a weed either through agronomy or weed control practice.



Figure 3 Life cycle of Galium aparine with usage herbicide[21]

These kinds of studies indicate that a minimum of 95% control, but preferably 98 – 100% effective and consistent control of weed- Galium aparine, is required in winter wheat to reduce the population level. The model also shows that herbicide is not the only way of managing Galium aparine populations. Cultural control methods can help ease the pressure on herbicide programmes. [21]

Chemical weed control is faced by many challenges in the new millennium. For example public awareness of environmental pollution is increasing. This results in stricter regulations for weed control and herbicide use. Furthermore the number of herbicide with new active ingredients put on the market has decreased considerably in the last years. In addition available herbicides become less effective due to emerging resistant weed biotypes. Thus, farmers in several countries are obliged to implement integrated pest management strategies, which do not only rely on chemical weed control. In order to support farmers challenged by these new requirements innovative methods need to be found and developed. For instance, multiple decision support systems have already been developed to maximise the weed control effect and to optimise the application of herbicides economically. In this chapter approaches to reduce the amount of herbicides applied in the fields are outlined. The potentials and technical possibilities of these different approaches and methods are presented and discussed [22].



Figure 4 Integrated weed Management

# CONCLUSION

Knowing weed, its nature of invasion and timely management can prevent major loss in crop and can increase overall economy. Few awareness steps must be kept in mind for weed management. BE UP-TO-DATE: Keep learning if any occurrence of new weeds and report to the national or government monitoring agencies. BE ON THE LOOKOUT: Periodically inspect areas near waterways, roads, corridors, wildlife. Whenever new gravel, fill materials or soil have been brought in from elsewhere must lookout periodically. DO NOT SPREAD SEEDS: Care should be taken not to spread seed mistakenly through clothing, pets, and tires for seeds. Use certified weed free materials. MINIMIZE DISTURBANCES: soil disturbances can be a prime area for new plant invasions to occur. ESTABLISH & MAINTAIN NATIVE PLANT COMMUNITIES: A healthy stance of desired vegetation will be less susceptible to invasion.

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