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Climate Smart Weed Management Practices

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Abstract

Climate changes are rapidly occurring due to anthropogenic activities. Human activities contribute to global warming by increasing greenhouse gases which are the main factors of extreme climate change. This change increases competition between weeds and crops. Most troublesome weeds are responsive to grow with increasing CO_2 gas then crop. Also, high atmospheric temperature helps to reduce uptake of herbicide due to more diffusion and rapidly dry droplets. There is an inevitable need to study how changing climate conditions are affecting crop-weed competition, weed life and herbicide effectiveness in order to create adaptation and mitigation plans for changing climatic scenario. The overall objective of this article is to portray smart weed management approaches under climate change scenario resulting high productivity of crops and more returns for farmers alongwith an effective maintenance of the weeds.

Keywords: Climate smart, Management, Weed, Weed control

Introduction

Climate change could threaten food security because it is a major deciding factor in the growth, development, and survival of all organisms. The relationships between crops and weeds over the long term will be impacted by climate change. Increasing CO_2 content and temperature are predicted to have an impact on agricultural production, water availability, sustainability and consequently on food security, both directly and indirectly. Due to climate change impact weed shifts are noted in different places different and weeds like *Lantana camara*, *Nassella neesiana*, *Parthenium hysterophorus*, *Acacia nilotica*, *Ulex europaeus*, *Prosopis glandulosa* Torr become dominant (Amare, 2016). Weeds can be controlled by the use of herbicides, but it has a number of disadvantages including the residual effect in food and environment. Different Climate smart approaches such as drip irritation, zero tillage, soil solarization, crop rotation, adjustment in row spacing, mulching, cover crops, crop residue retention, *etc*. methods can be used for weed control based on climate change.

Different Climate Smart Weed Management Approaches

Drip Irritation

Drip irrigation helps to conserve water in irrigated agriculture, as a way to boost income and fight poverty along with the improvement of the nutritional and food security of rural communities. Drip irrigation, according to respondents, is most beneficial for decreasing weed growth (70.00%), saving water (93.33%), increases crop yield (76.67%), improves produce quality (66.67%), uniform application (90.00%), an easy method of irrigation (86.67%) and reduce labour costs for irrigation (73.33%) (Eswaran, 2017). Palani *et al.* (2020) reported that different weed management practices with drip irrigation in aerobic rice resulted more tillers (442 m^{-2}) and grains (231 $panicle^{-1}$) then control.

Zero Tillage

Remaining residues in a zero-till system operate as a physical barrier against the establishment of weeds, regulate soil temperature, maintain soil moisture, supply organic matter, and enhance nutrient-water interactions. It is projected that for the delay of each day in wheat planting past the ideal date reduces yield by 26.8 kg $ha^{-1}day^{-1}$. In addition to this, zero tillage technology also lowers the occurrence of the most troublesome weeds, such as *Phalaris minor* in wheat (Singh *et al.*, 2015). In a 2 years period, zero tillage cultivation with paraquat increased the yield 16.3% than zero tillage without paraquat and 15.6% than conventional tillage (Walia *et al.*, 2005).

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Crop Rotation

Crop rotation introduces conditions and methods that are undesirable for a particular weed species, preventing its development and reproduction. Rice-wheat crop rotation had higher weed density, while sorghum-wheat rotation reduced weed density and biomass (Shahzad *et al.*, 2021). Summer crops added to wheat-based crop rotations have been shown to reduce the density of blackgrass by up to 99% (Zeller *et al.*, 2021).

Soil Solarization

Solarization and tarping are thought to work primarily by destroying weed seeds and seedlings through thermal death caused by heat buildup from the sun. Raising soil temperatures could expediate seed breakdown or encourage the suicidal germination of weed seeds due to the higher rates of microbiological and chemical reactions in the soil. In Brazil, three weeks of solarization increased double carrot yield and eliminated more than 50% of weed species (Marenco and Lustosa, 2000).

Figure 1 depicted that fresh weed biomass was significantly affected by solarization periods in both years of experimentation (2008 and 2009). Weed biomass is reduced over the solarization period than controlled. From the solarized plot, Fresh weed biomass obtained for 4, 6, 8, and 10 weeks during both the years were statistically minimal and comparable (Khan *et al.*, 2012). Most of the troublesome weeds can be controlled by the solarization such as *Cirsium arvense* and *Sorghum halepense* (Khan *et al.*, 2012). In summer, solarization is a reasonable choice for farmers to reduce *Poa annua* weed on which maximum herbicides have little impact (Khan *et al.*, 2012).

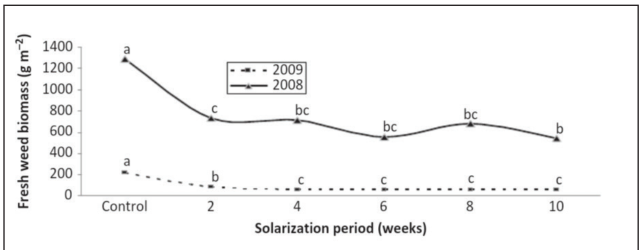

Figure 1: Effects of solarization on the weed fresh biomass (g m^{-2}) (Khan *et al.*, 2012)

Adjustment in Row Spacing

The overall number of tillers m^{-2} and the number of fertile tillers were considerably impacted by adjusting the crop row spacings. Wider row spacing lessens the crop's capacity to compete with weeds because it expands the area between rows where the weeds can grow and lowers the crop's ability to compete. In soybean two year cropping system, 50 cm row spacing soybean can decrease the density of total weeds by 21-42% and biomass of total weed to the tune of 20-25% than 75 cm row spacing of soybean in both years. Row spacing also influences the weed index. Daba and Mekonnen (2022) observed that the largest weed index (28.99%) was found in a rice row spacing of 30 cm, while the lowest weed index (21.24%) was found in a rice row spacing of 20 cm.

Conclusion

Smart weed management approaches are the best way to maintain the weed sustainability and environment. These approaches help to suppress weeds under climatic chance conditions and protect yield losses. These approaches also reduce excessive use of herbicide which can help increase resource sustainability. Therefore, it is required to give more importance on climate smart weed management approaches and to examine adaptation on mechanisms/ practices to support crop production under climate change scenarios while also evaluating their efficacy, time commitment, and financial and ecological consequences.

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