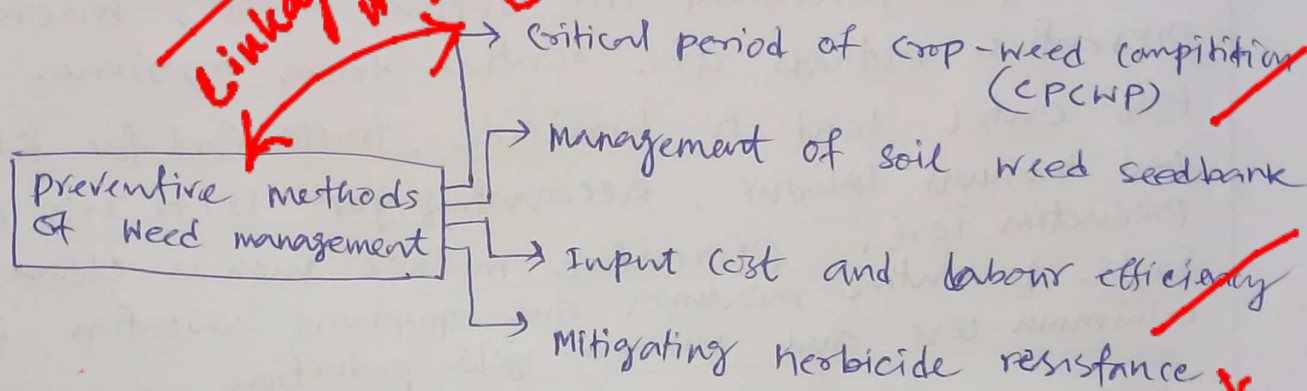


8 State why preventive methods of weed management ^{is always} better than control.

Q1 In agriculture, the phrase "prevention is better than cure" directly applies on weed management. Preventive weed management refers to the strategies aimed at prohibiting the entry, establishment and proliferation of weed seeds. In contrast, weed control involves eradicating and suppressing the weeds after already emerged and established, competing with crops.



① Critical period of crop-weed competition

Weeds compete with crop plants for its growth, taking light, soil, moisture, nutrients and other factors. Early emerging weeds act as aggressive nutrient sink, such as Amaranthus retroflexus (pig weeds) absorb N, P, K at 2-3 times the rate of young crop. And unchecked weed cause yield loss 34% and account for \$100 billions in annual economic losses.

② Management of soil weed seedbank:

preventive management directly targets the primary source of long-term weed pressures, the soil weed seedbank.

as a fecundity rate, a single unmanaged weed like Amaranthus species can generate over 20,000 seeds ~~per~~ per weed plant. As a seed longevity, Avena fatua seeds can persist for over 5-10 years. So, these ~~have~~ have to be managed before weed growing.

3 (c) Input cost and labour efficiency:

curative weed control requires continuous, high-cost input throughout the cropping season, whereas, preventive methods are routine farm hygiene. ~~Post~~ post control leads to herbicide, tractor fuel for tillage and manual labour, accounting for 15% to 30% of total production cost. preventive methods such as clean certified seeds, quarantine measures and equipment sanitation carry minimum cost and maximum yield production.

④ Mitigation of Herbicide resistance:

preventive measures reduces reliance on herbicides and prevent herbicide resistance.

Parameters	preventive weed management	curative weed control
Primary Focus	Prohibits entry, seed production and proliferation	Kill/suppress the weed seed
Timing	Proactive on pre-sowing and continuous field hygiene	Reactive on weed established
Yield impact	Protects 100% ~~of~~ yield	partial recovery
Cost	Low, and fixed maintenance invest	High cost, recurring cost (labour, fuel, ~~chemical~~)

preventive methods address- the root cause of weed germination, eliminating resource competition, mitigating herbicide resistance etc. These are foundation of Integrated weed management (IWM).

What is weed ecology? How weeds are related to soil, crop, climate

Q2

Weed ecology is the scientific study of the interaction between weeds and their surrounding biotics and (soil, crop, microorganism) and abiotic factors (soil, climate). It focuses on the mechanisms governing weed survival, germination, proliferation and spatial distribution, seedbank, and successional adaptation within managed agroecosystem.

A) Interaction Between Weeds and Soil:

- Soil acts as the primary reservoir for weed survival through the soil weed seedbank, containing 10,000 to 100,000 seeds per square metre on top soil (0-15cm)

- Soil pH, texture, organic matter and moisture dictate weed composition. Cyperus Rotundus (purple nutgrass) thrives in heavy, moist soil.

- Weeds are aggressive nutrient scavengers. Species like Amaranthus retroflexus (pigweed) absorb N, P, K at 2-3 times the rate of crop, during early stage.

B) Interaction between weeds and crops:

- During the crop growth, weed competes with crop and causing yield loss (34% annually, loss globally)

- Certain weeds release alleopathy, biochemical compounds that inhibits the crop germination and growth. For example - Rathenium hysterophorus release phenolic acids and suppress the crop growth.

- Weeds exhibit seed's primary and secondary dormancy mechanism, allowing them to remain inactive in the soil seedbank until environmental optimum conditions.

③ Interaction between weeds and climate:

- seed ~~dormancy~~ dormancy breaking relies on the specific soil moisture and temperature thresholds.
- under rising CO_2 level, C_4 weeds (Amaranthus) maintain high water-use efficiency, while C_3 weed often exhibits vegetative growth.
- weed possess high genetic diversity, adapting extreme weather,

Factors	Ecological mechanism	~~influence~~ ~~effects~~ Agronomic impact
Soil	Seed bank persistence and tillage	it increases emergence density per season
Crop	~~yield~~ Alleopathic roots and seed dormancy	Yield loss, defoliate herbicides through alleochemicals.
climate	CO_2 concentration and photosynthesis	alter physiological growth C_3 and C_4 species, and diversify the genetics.

Weed ecology highlights that weeds are not isolated pests, but highly adaptive components of ~~agro~~ agro-ecosystems, responding to soil properties, crop competitions and climatic variabilities.