that are 10-15 cm in height. If weeds are above 10-15 cm, they should be slashed back and sprayed a week or 10 days after slashing. By incorporating 1% urea into the spray solution, chemical weeding expenses can be reduced by approximately 50%. Specifically, when urea is added to the solution at a rate of 2 kg per barrel, the required dosage of Gramoxone can be decreased to 250 ml/barrel. This reduction in dosage of weedicide will not compromise the efficiency of these weedicides in combating weeds.

5. **Mechanical weed control:** Mechanization of weeding operation in coffee estates has been attracting attention of researchers and also coffee farmers in recent years. The hand-held mechanical weed/brush cutters would be more economical compared to manual method and chemical method of weeding which would also ensure saving of precious man days for other important cultural operations during critical periods. Caution should be taken that when the weeds are moist avoid using weed cutters to avoid spreading of *Myrothecium* inoculum.

Weeding by brush weed cutter

INTEGRATED WEED MANAGEMENT: Integrated weed management (IWM) is a long-term management approach to control/manage weed that integrates different methods of weed management techniques such as manual, cultural chemical and mechanical

Weeding by tractor mounted weed slasher

control of weed to provide the crop with an advantage over weeds.

Advantages of IWM: IWM has the potential to restrict weed populations to manageable levels, reduce the environmental impact of individual weed management practices, increase cropping system sustainability, and reduce selection pressure for weed resistance to weedicides.

By using several techniques to control weeds we can reduce the chance that weed species will adapt to the control techniques, which is likely if only one technique is used. For example, if a weedicide is used over a long period of time, a weed species can build up a resistance to the chemical.

- IWM strategy should focus on the most economical and effective control of the weeds and include ecological considerations.
- The long-term approach to IWM should reduce the extent of weeds and reduce the weed seed stock in the soil.
- It should consider how to achieve this goal without degrading the desirable qualities of the land/soil, such as its native ecology or agricultural crops.

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INTEGRATED WEED MANAGEMENT IN COFFEE

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Weed is a plant considered undesirable, unattractive or troublesome, especially one that grows or spreads fast or takes the place of desired plants. It competes with coffee plants for water, light and mineral nutrients. It results in reduction of yield of coffee by 30-50% It may harbour insects and provide a host for certain plant pathogens. If weeds are allowed to grow during late post-monsoon period, they use the soil moisture which coffee needs in the following dry weather. In young clearings weeds are a serious problem particularly during first three years. The pruned fields where ground is exposed are also prone to weed problem. Weeds interfere with operations like spraying and harvesting.

Common Weeds in Coffee

1) **Monocot weeds:** *Cyperus sp., Cynedon doctylon, Elephant grass, Paspalum sp.*

2) **Dicot weeds:** *Eupatorium, Drimeria, Tridax,* etc.

Methods of weed control

1. **Manual weeding:** Generally, weeds are controlled manually. New clearings are hand-weeded three to four times and established coffee fields two to three times a year. During the monsoon season weeds are slashed back (slash weeding) with the help of a matchet (dabbe). Clean weeding is generally done during post-monsoon period. It is a labour intensive and time-consuming operation in coffee estates.

2. **Cultural methods:** In new clearings, the field is given a thorough digging (cover digging) to a depth of about 15-18 inches, towards the end of monsoon. All weeds and vegetative debris are completely turned over and buried into the soil. In established plantations (2 & 3 year old plant), scuffling and mulching at the end of monsoon can be effective in controlling weeds. In sloping terrain, avoid soil digging to prevent soil erosion. In such areas, adopt only

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Manual weeding

slash weeding. mulching with weed slashings and shade tree leaf litter etc. would also help in smothering of weeds.

3. **Cultivation of green manure crops/ cover crops:** In young clearings, coffee at normal spacing covers only a small portion of soil surface and there is room for prolific weed growth. Inter planting of green manure crops, cover crops and annual crops such as legumes, cassava, beans, pigeon pea, yam, sweet potatoes, vegetables, pineapple etc., help in suppression of weed growth to a large extent. When flowering of cover crops is noticed it has to be slashed and incorporated into the soil, thereby it will improve the organic matter status of the soil. Cover crops like cowpea and horse gram contributed about 6MT and 3MT of fresh biomass per hectare respectively, which is equivalent to a nutrient contribution of 21:5.4:21 kg NPK/ha and 11:3:11 kg NPK/ ha respectively. They also ensured about 90% suppression of weed growth in young coffee fields.

❖ Importance of cover crops in weed management

- Smothers weed growth by shade
- Addition of nutrients to soil
- Improvement of soil health and organic matter status
- Fixes atmospheric Nitrogen in soil
- Prevents moisture loss and soil erosion

4. **Chemical weed control:** Weed control by using different type of chemical weedicides adversely impact the soil eco-system. Hence, use of chemical weedicides is *not encouraged in coffee plantations.* Earlier, chemical weed methods were used in large holding mainly to control weeds in paths, open patches etc. when adequate labour force was not available. However, of late because of the negative effects of weedicides decline in the population of beneficial microorganisms and the risk of chemical residues, the chemical weed control methods are least preferred. Moreover, the advent of efficient weed/brush cutters are becoming popular because of their efficiency, economical and eco-friendly advantages. Nevertheless, in case the use of chemical weedicides is *inevitable due to practical limitations and scarcity of plantation labour,* chemical weedicides may be preferred as a last option as only target sprays to bring the weeds under control and not as blanket sprays. Even in such situations, only contact weedicide like Paraquat-di-chloride 24% EC @ 0.067 % a.i. (Gramoxone @ 500 ml per barrel/acre) should be preferred.

❖ Selection of sprayers and nozzles: For applying weedicides, knap-sack or backpak sprayers (low pressure, high volume) with plastic containers are recommended. The sprayers used for weedicide application should be properly labelled and thoroughly washed after each application. It is advisable not to use these sprayers for spraying pesticides, fungicides and nutrient mixtures. For optimal results, apply recommended weedicide on a sunny day when the soil is moist and weeds are in an active growth phase, but before they reach the flowering and seed-setting stage. Initiate the first blanket application towards the end of April or early May, targeting weeds

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