

## WEED CONTROL IN RUBBER PLANTATIONS

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Weeds are considered undesirable for various reasons, mostly connected with decreased economic return from the land. Noxious weed species growing in the inter-row areas during the immature period can compete with rubber for soil moisture, light and nutrients thus affecting the growth and yield of rubber plants and also hinder the routine estate practices such as tapping, spraying and fertilizing. Some weeds contain growth substances, which can suppress the growth of *Hevea* and also act as hosts for many pests and diseases of rubber. Weed control is therefore considered important in rubber plantations.

### Occurrence of Weeds

Establishment of a ground cover is essential in clearings, particularly when rubber plants are young and much of the soil is completely exposed to the elements. Unfortunately, due to competition with strongly established grasses and compositae, it has not always been a reasonable economic proposition to persist with a legume cover. There is no doubt that by vigorous hand weeding and scraping such competition might be overcome, but the cost is high and the effect on soils already heavily eroded, is disastrous. The problem then is to cultivate the land —

- to the detriment of the existing "weed" population;
- to the benefit of the cover crops to be established;
- without harm to the young rubber plants ;
- without causing excessive susceptibility to erosion.

### Weed Control Problems

The nature of weed control problems in rubber plantations can be categorised as follows :

- (1) weed control at the time of re-planting prior to establishment of leguminous cover crops;

- (2) elimination of weeds in areas where cover crops have been established.
- (3) maintenance of the planting rows in a clean-weeded condition during the first few years from the time of replanting;
- (4) weed control in mature areas.

Some weeds common in rubber plantations in Sri Lanka are given below :—

<i>Botanical Name Grasses</i>	<i>Sinhala</i>	<i>Tamil</i>
01. <i>Axanopus affinis</i> (carpet grass)	.. —	.. —
02. <i>Panicum repens</i> (couch grass)	.. Atora/Atawara	.. Aruku
03. <i>Paspalum conjugatum</i> (sour grass)	.. —	.. —
04. <i>Imperata cylindrica</i>	.. Illuk	.. —
05. <i>Lophatherum gracile</i>	.. Bata thanakola	.. —
06. <i>Digitaria longiflora</i>	.. —	.. Usi pillu
07. <i>Penisetum polystachyon</i>	.. Mana (Rilathana)	.. —
08. <i>Cyperus rotundus</i>	.. Kalanduru	.. Korai
09. <i>Cynodon dactyloan</i>	.. Kukul atawara	.. Aurgam pul
10. <i>Ottlochloa nodosa</i>	.. —	.. —
11. <i>Brachiaria brizantha</i>	.. —	.. —
<b>Ferns</b>		
01. <i>Gleichenia linearis</i>	.. Kekilla	.. Meena
02. <i>Adiantum</i>	.. —	.. —
03. <i>Nephrolepis</i>	.. —	.. —
<b>Broad leaves</b>		
01. <i>Mikania scandens</i>	.. Wathupalu	.. Thaneer kodi
02. <i>Hedyotis auricularia</i>	.. Getakola	.. Aval thatoo kodi
03. <i>Drymatia cordata</i>	.. Kukupala	.. Kadalai pillu
04. <i>Centella asiatica</i>	.. Gotukola	.. Vullarai
05. <i>Crassocephalus crepidioides</i>	.. Hulanthala	.. Thondam pillu
06. <i>Ageratum conyzoides</i>	.. Hulanthala	.. Poththu pillu
07. <i>Ipomea cymosa</i> (morning glory)	.. Hcen madu	.. Tala neli
08. <i>Eupatorium</i> (siam weed)	.. Podisinghomaran	.. Puundu pillu
09. <i>Commelina indica</i>	.. Girapala	.. Amalai
10. <i>Borreria ocymoides</i>	.. Getakola	.. —
11. <i>Emilia javanica</i>	.. Kadupahara	.. Mammoty pillu
12. <i>Mimosa pudica</i>	.. Nidikumba	.. —
13. <i>Tridax procumbens</i>	.. —	.. —
14. <i>Clerodendron infortunatum</i>	.. Pinna	.. —

More information on the distribution and dispersal of weed species occurring in rubber plantations and control methods is given in Table 1.

## **Weed Management/Control**

It is very important in this connection to remember that the Sri Lanka rubber land is, in general, very steep, very rocky or broken and uneven and relatively difficult to traverse even on foot.

The possible methods of weed control in rubber lands can be categorised as —

- \* Hand weeding (scraping, mamoty etc.)
- \* Mechanical methods
- \* Burning
- \* Ground cover management
- \* Mulching
- \* Intercropping
- \* Livestock grazing and
- \* Chemical Method

The choice of a particular method for systematic management of weeds largely depend on the age of the rubber stand, climatic conditions, type of weed and its distribution and on the size of holding.

### **Hand Weeding**

This method is completely effective but is very often expensive, besides it tend to cause severe erosion. Scraping with mammoties breaks down the structure of the soil and leaves on the ground a layer of loose top-soil which is easily washed away by rain. In addition, this will not only prepare a suitable bed for weeds to grow but also stimulate dormant seed to germinate.

Hand weeding is very effective when establishing cover crops in areas carrying heavy weeds. This involves gradual removal of weeds around the cover beds to allow the covers to spread, eventually covering the entire area. Hand weeding is also done on strips of about 1.2 m to 1.8 m (4–6 ft.) wide along the planting rows or in circles of about 0.6 m to 0.9 m (2–3 ft.) radius round each rubber plant. Another situation where hand control of weeds could prove to be advantageous or even necessary is in the selective elimination of weeds in areas where cover crops have been established.

### **Mechanical Method**

This method is virtually impossible owing to the type of land. In few areas where the flatness of the land is sufficient to permit mechanical cultivation, the amount of rock on the surface and immediately underneath makes it impossible.

### **Burning**

The traditional practice of burning, to control *illuk* in rubber plantations should not be continued, for *illuk* being fire resistant will only aggravate the problem by rapid

regeneration. Further, setting fire particularly in the dry areas could cause damage or even death of rubber plants. Except for opening new clearings burning is not practicable and in any case is a most undesirable practice.

#### **Ground cover management practice**

Management of ground covers is very effective in suppressing weed growth in young rubber clearings and is essential for the preservation of fertility and soil conservation and for disease control.

In the last two decades a great deal of work on the effects of different cover plants on rubber growth and yield have been reported. But the effects are known to vary from place to place and this has been attributed largely to variation in soil and climatic factors.

Leguminous plants are the most useful ground covers, as besides other attributes which may also be possessed by other species the legumes can fix atmospheric nitrogen when growing under the right conditions and with the correct strains of bacteria for each species.

*Quality of a good cover crop* : To be a good cover crop, the plant selected should possess the following characters :—

- (i) Easily multiplied, preferably by seed
- (ii) The root system, should be such that it does not compete with the rubber, yet have good soil binding properties and not require high quality soils
- (iii) The growth should be rapid and there should be abundant leaf both in full sunlight and shade
- (iv) Tolerate pruning or slashing
- (v) Resistant to draught, pests and diseases
- (vi) A good competitor and be able to resist and suppress weeds
- (vii) Easily eradicated when required
- (viii) Suitable for land reclamation and afforestation
- (ix) Should not form products which are toxic to the main crop.

*Cover crop species and mixtures* : A list of the more important plants used as cover crops in rubber and their seed rate is given below :—

- Pueraria phaseoloides 5.6 – 7.8 kg. of seed/ha (5 – 7 lb./area)
- Desmodium ovalifolium 5.6 – 7.8 kg. of seed/ha (5 – 7 lb./area)
- Calopogonium mucunoides 13.5 kg. of seed/ha (12 lb./ area)
- Centrosema pubescens 26.9 kg. of seed/ha (24 lb./area)
- Stylosanthes gracilis 4.5 kg. of seed/ha (4 lb./area)
- Mimosa invisa 4.5 kg. of seed/ha 4 lb./acre)

In high rainfall areas any of the above legume species can be planted. In low rainfall areas *Stylosanthus* should be avoided. A cover consisting of two or more species of legumes is often preferred in order that the shade or drought resistance or other qualities of one may be off set by those of the other.

In Sri Lanka, a mixture of *Pueraria* and *Desmodium* is popular as *Pueraria* grows rapidly at the early stages of a clearing but stands only light shade whereas *Desmodium* is of weaker initial growth, but tolerates shade much better and persists more satisfactorily under a fairly dense canopy of rubber.

*Establishment of covers* : Cover crops are best established immediately after clearing. Either seeds or cuttings should be planted according to the species, being used. With creeping covers which roots at the nodes, such as *Pueraria*, *Calopogonium* and *Centrocema* the cuttings or seeds may be spaced upto 6 ft. (183 cm.) apart as they rapidly cover the intervening spaces. Types such as *Desmodium* however must be planted closely as they do not spread extensively.

In areas carrying heavy weeds, clean-weeded strips should be formed and the seeds or cuttings should be planted in these strips. When established, the intervening strips of weed growth should be gradually removed to allow the covers to spread eventually covering the whole area. In such areas, however, only the creeping types which will spread and tend to smother the weeds, should be used. Cover plants may be grown in nurseries and planted as basket or ball plants in areas where risks of dry periods are present.

*Seed treatment* : Some species of leguminous cover plants have seeds which, unless specially treated, do not germinate quickly. Seeds which can be advantageously treated are *Pueraria* and *Desmodium*.

The seeds should be either soaked in hot water (60° C-80°C) for 24 hours leaving the water to cool) or treated with sulphuric acid.

For acid treatment the seeds should be placed in a glass or other acid resistant container and sufficient concentrated sulphuric acid should be added to cover the seeds. After about 15 minutes during which period the mixture may be stirred occasionally, the acid should be drained off carefully and the seed should be transferred into cold water. The seeds should be then washed thoroughly in several changes of cold water to remove the acid. The seeds may then be lightly dried to facilitate handling while planting.

*Manuring of covers* : When establishing leguminous covers in beds or strips in a plantation, a dressing of 100 g. of rock phosphate per square meter (3 oz./square yard) would be beneficial.

Phosphate is one of the important nutrients required by legumes for satisfactory growth. This may be effectively applied by dusting some rock phosphate on the cover crops. This could be done at the rate of 100 to 200 kg. per hectare (90 - 180 lb./acre/year) in the first years, depending on the growth of covers.

**Mulching :** If sufficient material for mulching such as slashed cover, straw etc. is available mulching the inter-row area could be a satisfactory method of weed control.

Planting tree legumes like *Flemingia*, *Sesbania*, *Tephrosia* and *Gliricidia* and formation of a mulch of leaf litter between planting rows by slashing and mulching is also a desirable method of weed control in immature rubber plantations.

### **Intercropping**

It is another excellent method of weed management in rubber. Studies conducted by the RRI, have revealed that intercropping with banana, passion fruit and pineapple, if done, systematically, will not cause any adverse effects on the growth and yield of rubber. This method of suppressing weeds in rubber is suitable to both estate and small holder situations.

### **Livestock grazing**

Controlled grazing by livestock like sheep, goats and the rearing of chicken under rubber can bring weeds under effective control.

### **Chemical control of weeds**

The nature of herbicides to be used in chemical weed control programmes is dependent on a number of factors :—

- \* The nature of the plants that are regarded as weeds;
- \* The objective of weed control, and the degree of control necessary ;
- \* Costs of herbicides and their application.

The Rubber Research Institute has made recommendations regarding the use of MSMA (Mono Sodium Methane Arsenate) — based mixtures depending on the main weeds present, on the degree of shade under the rubber and on local soil conditions. MSMA is an organo — arsenic, post emergent herbicide. Toxicologically this is much less poisonous than sodium arsenite.

Mixture I — MSMA (0.825 lb to 1.65 lb) — Amitrole (0.188 lb to 0.375 lb)

This could be used in a situation where *Paspalum Conjugatum* is solely dominant.

Mixture II — MSMA (0.825 lb to 1.65 lb) — 2.4 — D (amine) (0.6 to 0.9 lb).

This could be used on a mixed growth of *Paspalum conjugatum* and *Mikania Scandens*.

Mixture III — MASM (0.825 to 1.65 lb) — 2.4 D (amine) (0.6 to 0.9 lb) — Sodium chlorate (4 to 5 lb)

Mixture IV — MSMA (0.825 to 1.65 lb) — 2.4 — D (amine) (0.6 to 0.9 lb) — Dalapon (0.85 to 1.70 lb)

Mixture III and IV could be used on a mixed growth of *Paspalum conjugatum*, *Mikania scandens*, *Axonopus affinis*, *Borreria hispida*, *Borreria ocymoides*, *Hedyotis auricularia* and other weeds. The dosage of the components of these mixtures will depend on the height and density of the weed population and conditions of growth-open or shade. In open non shaded areas where the weeds are strong and thick, then obviously higher rates are necessary.

Glyphosate (Roundup) is a water-soluble, translocated herbicide and therefore could kill underground parts of many perennial weeds when sprayed on the foliage. It can produce phytotoxic symptoms on any plant it comes into contact with either by spraying or due to spray drift. The herbicide however is inactivated when it comes into contact with the soil. Glyphosate has been found to be effectively control couch grass and *illuk* when used at the rate of 4.4 kg active ingredient in 600 litres of water per hectare.

Paraquat (gramoxone) is effective in controlling weeds in rubber plantation when used at the dilution rate of 1 fl. oz. to 2- gallons of water.

table 1

## MAJOR WEEDS IN RUBBER LANDS AND THEIR CONTROL

<i>Local &amp; Botanical Names of Weed</i>	<i>Distribution In Rubber Growing Areas</i>	<i>Propagation and Dispersal</i>	<i>Methods of Control</i>
<b>Grasses</b>			
01. <i>Axanopus affinis</i> (Carpet grass)	A dominant weed in rubber growing areas, like Kalutara & Kurunegala	Bushes grow about 2-3 ft. high. Roots dense. Propagation by wind dispersal of seeds, and by underground, rhizomes	Slashing during tender stages. Uprooting and burying. Application of MSMA mixture III & IV.
02. <i>Panicum repens</i> (couch grass)	Distributed in all rubber growing areas.	Consist of underground rhizomes. Propagation by seeds and root cuttings.	Manual weeding. Underground rhizomes should be uprooted and burnt. Repeated slashing, grazing, harrowing are suitable. Weedicide, application like Roundup.
03. <i>Paspalum conjugatum</i> (Sour grass)	A troublesome weed in all rubber growing areas.	Grows rapidly. Propagation by seeds and root cuttings.	Mammoth weeding. Uprooting and burning before flowering. Application of MSMA mixture I and II.
04. <i>Imperata cylindrica</i> (illuk)	A troublesome weed in all rubber growing areas.	Grows year round. About 2-3 ft. high. Flowers silvery white, 3-8 inches long. Roots dense. Propagation by wind dispersal of seeds and by underground, rhizomes Flowering starts in July.	For small holdings Digging of underground rhizomes, drying and burning For large estates Application of Roundup. 4.4 kg active ingredient in 600 liters per hectare
05. <i>Lophatherum gracile</i> (Bata thanakola)	Distributed in all rubber growing areas	Bushes grow about 2-3 ft. high. Propagation by seed and root cuttings.	Slashing during tender stages. Application of paraquat at the dilution rate of 1 pl. oz. to 2 1/2 gallons of water.
06. <i>Digitaria longiflora</i>	A common grass in all rubber lands.	Annual grass, tufted. Culms geniculate and branching at nodes. 1 1/2 ft. high. Propagation by seeds.	Application of Paraquat at the dilution rate of 1 fl. oz to 2 1/2 gallons of water.

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07. <i>Pennisetum Polystachyon</i> (Rilathana)	Distributed in all rubber growing areas.	Bushes grow 4 – 6 ft. high. Flowering season in Nov. – Dec. Propagation by seed and root cuttings.	Slashing during tender stages. Uprooting and burning.
08. <i>Cyperus rotundus</i> (Kalanduru)	Grows vigorously in all rubber growing areas.	Perennial sedge, rhizomatous and stoloniferous. Bushes grow 1–2 ft. high. Propagation by tubers.	Manual weeding and Application of Roundup 4.4 kg active ingredient in 600 litres of water per hectare.
09. <i>Cynoden dactylon</i> (Kukul atawara)	A common grass in all rubber growing areas.	Grows year round. Smaller in size compared to couch grass (atawara). Propagation by seeds and rhizomes cuttings.	Manual weeding. Under ground rhizomes should be uprooted and burnt. Repeated slashing and application of Roundup.
10. <i>Ottochloa nodosa</i>	A dominant weed in rubber growing areas like Kegalle, Kalutara S Kurunegala	A tufted grass. Culms geniculate and branching at nodes. Propagation by root cuttings.	Manual weeding. Application of Roundup or Paraquat.
11. <i>Brachiaria brizantha</i>	Distributed in rubber growing areas like Kegalle and Kalutara.	Perennial grass. Spreading and creeping, rooting at nodes. Propagation by runners and seeds.	Slashing during tender stages. Application of Roundup or Paraquat.
<b>Ferns</b>			
01. <i>Gleichenia linearis</i> (kekilla)	Abundant weed in Kellani valley and Kalutara rubber growing areas.	Zigzag fronds repeatedly branching. Spore capsules on the back of the frond, each one at the end of a veinlet.	Repeated slashing or mamoty digging.
02. <i>Adiantum</i>	Grows vigorously in Kellani valley, Kegalle and Kalutara rubber growing areas.	Repeatedly branching at root nodes. Spore capsules on the back of the fronds. Propagation by underground rhizomes.	Repeated slashing or mamoty digging.
03. <i>Nephrolepis</i> spp.	Abundant in Kalutara and Kellani valley areas.	Propagated by underground rhizomes and root nodes.	Repeated slashing or mamoty digging.

<i>Local &amp; Botanical Names of Weed</i>	<i>Distribution in Rubber Growing Areas</i>	<i>Propagation and Dispersal</i>	<i>Methods of Control</i>
<b>Broad Leaves</b>			
01. <i>Mikania scandens</i> (Wathupalu)	A trouble-some weed in all rubber growing areas.	Perennial climbing creeper. Grows twining round rubber plants. Basal root formation covers the manuring circle of rubber lands. Grows vigorously with ground cover.	Mammoty weeding and slashing or by hand weeding. Application of MSMA Mixture II, III & IV.
02. <i>Hedyotis auricularia</i> (Getakola)	A dominant weed in Kalutara, Kurunegala and Kelani valley areas.	Annual with numerous Prostrate Branches. Propagation by seeds.	Creepers dry up with Jan - March dry spells. Slashing or application of MSMA mixture III & IV.
03. <i>Drymaria cordata</i> (Kukulpala)	One of the commonest weeds in all rubber growing areas.	Annual weed. Propagation by seeds.	Slashing and mammoty weeding. Application of Paraquat at the dilution rate of 1.1l oz to 2 1/2 gallons of water.
04. <i>Crassocephalus crepidiodes</i>	Distributed in all rubber growing areas.	Annual weed. Propagation by seeds.	Mammoty or hand weeding.
05. <i>Ajeratum conyzoides</i> (Hulanthala)	Distributed in all rubber growing areas	Annual weed. Propagation by seeds.	Mammoty or hand weeding.
06. <i>Centella asiatica</i> (Gotukola)	Less troublesome weed in Kalutara Kellani valley areas.	Spreading and creeping, rooting at nodes. Propagation by runners	Hand weeding. Application of Roundup 4.4 kg active ingredients in 600 litres of water per hectare.
07. <i>I pomea cymosa</i> (morning glory)	Distributed in all rubber growing areas.	Perennial weed. Propagated vegetatively and by seeds.	Mammoty and hand weeding.
08. <i>Eupatorium odoratum</i> (Podisinghomarn )	Dominant weed in Kalutara, Kurunegala S Kegalle rubber growing areas.	Perennial shrub. Fast growing 7-9 ft high. Flowers Dec. - Jan. Seed dispersal by wind.	Mammoty weeding, uprooting and burning before flowering.
09. <i>Commelina indica</i> (Giripala)	Distributed in all rubber growing areas.	Perennial herb. Bushes grow 2 - 3 ft. high, flowers blue in colour. Propagated by creeping stems and seeds.	Mammoty weeding.
10. <i>Borreria ocymodes</i> (Getakola)	One of the commonest weeds in all rubber growing areas.	Annual shrub. Propagated by seeds.	Mammoty weeding. Application of MSMA mixture III and IV.

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11. <i>Emilia javanica</i> (Kadupahara)	Distributed in all rubber growing areas.	Annual shrub. Flowers small and purple in colour. Propagated by seeds.	Mammoty weeding.
12. <i>Mimosa pudica</i> (Nidikumba)	Distributed in all rubber growing areas.	Thorny herb. Pink flowers. Propagated by root nodes and by seeds.	Digging and burning. Slashing during tender stages.
13. <i>Tridax procumbens</i>	Distributed in all rubber growing areas.	Annual herb. Grows 1 ft. high. Propagated by seeds.	Mammoty weeding.
14. <i>Clerodendron infortunatum</i> (Pinna)	Distributed well in Kalutara district.	Grows high. Produces red flowers. Propagated by seeds and root Cuttings.	Mammoty weeding and slashing