招 請 講 演
Invited Lecture

Weed Control in the Tropic Zone[1)]

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The tropic zone is bounded by the Tropic of Cancer, 23½ degrees north and by the Tropic of Capricorn, 23½ degrees south of the equator. There are only slight changes in temperature in this zone and seasonal variation is controlled not by temperature but by precipitation. Hence, we have in the tropics, wet and dry seasons, characterized by the amount of rainfall. The length of each season varies. Areas above the equator usually experience typhoons (strong winds and heavy rains) during the wet season and occassionally also during the dry season.

Since there is only a slight change in temperature throughout the year, growth of vegetation is continuous. Hence propagules are produced and deposited into the soil successively without interruption. Only a long drop spell can cause drying up of topgrowth but as soon as the first rain of the monsoon season comes, regrowth is very rapid.

Cropping Systems

Monoculture

1. Continuous lowland rice: This system is possible in areas well served by irrigation. With most high yielding varieties maturing at 95 to 110 days, crops can be grown a year in many cases.

2. Continuous corn: This system is practiced in areas where either rainfall is distributed throughout the year or irrigation facilities are always available.

3. Vegetables – Vegetables particularly those of temperate origin are grown throughout the year where the temperature is cool throughout the year.

4. Fruit Crops – Pineapple/Sugar cane, Rubber, Oil Palms

5. Root Crops –

Upland Crops Sequential Cropping

1. Lowland rice – vegetables/legumes – This system is usually practiced in rainfed areas. After lowland rice vegetables such as tomatoes, beans, garlic, onion, watermelon are grown sometimes without land cultivation.

2. Upland rice – corn/beans/vegetables – This is common also in rainfed areas where the second crop is planted immediately after rice is harvested to take advantage of the residual moisture in the soil.

Intercropping

1. Cereal – legume
2. Papaya – upland rice
   Papaya – pineapple – legumes
3. Plantation crops – ginger/daisies/root crops

Pastures

Common Weeds Associated with Crops

Lowland Rice:

Echinochloa spp.
Monochoria vaginalis
Cyperus difformis
Sphenoclea zeylanica
Fimbristylis litoralis
Cyperus iria
Scirpus supinos
Scirpus maritimus
Salvinia molesta

Upland Crops:

Cyperus iria
Rottboellia exaltata
Digitaria sanguinalis
Amaranthus spinosus

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Celosia argentea
Portulaca oleracea
Ipomoea spp.
Cleome spp.
Trianthema portulacastrum
Boerhavia spp.

Plantation Crops:
Paspalum spp.
Imperata cylindrica
Mikania spp.

Weed Control Methods

Lowland Rice: Farmers in the tropics practice a wide range of weed control methods in this crop depending on the size of farm and the economic status of the farmer. Handweeding is common among small farmers. It may be the only weed control used or combined with rotary weeding and chemical method. With the high cost of pesticides, farmers in the Philippines particularly underdose in their herbicide application are broadcast in a field with standing water. Weed problem here is more serious since weeds and rice emerge almost simultaneously. Handweeding is not possible. Chemicals are usually more selective when applied days before seeding.

Upland Rice: Upland rice is mostly handweeded. Where chemical control is used, propanil and 2,4-D are usually used.

Corn: Weeds in corn are controlled by:

a. cultivation
b. handweeding
c. chemicals

Rice-Based Cropping Systems

Upland or lowland rice followed by cash crops

Zero tillage or minimum tillage has been offered as a solution to decrease production cost. The technology, however, calls for chemical control with the use of a general weedkiller prior to planting.

Stale seedbed technique – the land is prepared for planting but planting is delayed. Instead, weeds are allowed to sprout and 7-10 days after emergence, a general weedkiller without soil residual activity is applied. The crop is sown a day or two after herbicide application. The technique is designed to take of the advantage first flush of weed emergence. The second flush may be fewer and can be easily handled by handweeding.

Plantation Crops – We find in the tropics rubber, oil palms, rea coffee, bananas, etc. These crops are infected in most cases by perennial grasses and broadleaves. Slaching is usually employed but chemical control is highly acceptable for sustained control. Paraquat, glyphosate and combinations are currently popular.

Vegetables

Most vegetable crops are handweeded. This is primarily due to the relatively high cost of herbicides and the absence of highly selective herbicides in some cases. Furthermore, many vegetables are grown in backyard gardens with small areas.

Legumes

Peanut, mungbean and soybean are the most important legumes in many tropical countries. Although handweeding is the most common method employed. There are selective herbicides which are used in big commercial farms. Trifluralin, pendimethalin and oxyfluorfen have been suitable in many places.

Root Crops

Aside from being food materials, root crops are used as sources of alcohol in efforts to develop alternative energy sources. As such herbicide use is very acceptable but the availability of highly selective herbicides is a big constraint.

Conclusion

An overall view of weed control in the tropics show a blend of manual, mechanical and chemical measures. The deciding factor in the use of chemicals is the yield and market of the crop. In crops were high yielding varieties have proven their

performance, herbicide use is spreading and increasing particularly in the Southeast Asian Countries.

Comparative Yield Reduction of Rice Under Direct Seeding and Transplanting at the Experimental Farm of the Central Rice Research Institute, Cuttack, India (Adapted from G.B. Manna, Unpublished).

Weeding treatment	Grain yield (t/ha)		
	Direct-seeded		Transplanted
	Dry-seeded	Wet-seeded	
Hand weeding	5.0	4.8	5.3
Unweeded control	2.7	3.9	4.7
Yield loss due to weeds (%)	46	20	11

Cultivated and Rice Land in Southeast Asia

Country	Total land under cultivation (1000 ha)	Land devoted to rice (100 ha)	Percent of total cultivated land devoted to rice
Burma	8,903	5,261	59
Ceylon	869	583	67
Hongkong	103	4	4
Indonesia	21,700	8,500	39
Khmer Republic	1,813	1,422	78
Laos	1,885	688	36
Malaysia	3,171	517	16
Philippines	8,256	3,238	39
Thailand	11,332	7,689	68
Vietnam, North	2,024	1,497	74
Vietnam, South	3,076	2,550	83
Total	63,132	31,949	51

Most Common Weeds in Tropical Crops

Lowland Rice		
Transplanted	Irrigated	Rainfed
Dapog	*Echinochloa* spp.	*Paspalum* spp.
Wet bed	*Monochoria vaginalis*	*Cynodon dactylon*
	Cyperus difformis	*Echinochloa* spp.
	Sphenochloa zeylanica	*Cyperus iria*
Direct-seeded	*Echinochloa* spp.	*Echinochloa colona*
(Pre-germinated)	*Monochbria vaginalis*	
	Cyperus difformis	
Upland Crops (Rice, Corn,		*Digitaria sanguinalis*
Vegetable, Legumes)		*Cyperus rotundus*
		Rottboellia exaltata (corn)
		Boerhavia diffusa (corn)
		Ipomoea triloba
		Trianthema portulacastrum (onion)
		Commelina benghalensis
		Cleome spp.
		Amaranthus spp.
Plantation Crops		*Imperata cylindrica*
		Paspalum spp.
		Mikania spp.

The Most Promising Herbicides for Use in Tropical Root Crops

Sweet potato	Cassava	Yams	Taro
	Pre-Planting		
EPTC	Butylate		Trifluralin
Nitralin	Trifluralin		
Trifluralin			
Vernolate			
	Pre-emergence		
Alachlor	Alachlor	Alachlor	Ametryne
Chloramben	Diuron	Ametryne	Atrazine
Chlorbromuron	Fluometuron	Atrazine	Chloramben
Chlorthal	TCA	Chlorthal	Linuron
Diphenamid		Linuron	Methazole
Metobromuron		Metribuzin	Monolinuron
Napropamide		Simazine	Nitrofen
Noruron		TCA	Oxadiazon
Prometryne			Prometryne
			Simazine
	Post-emergence		
Paraquat	Dalapon	Dalapon	Dalapon
	Diuron	Paraquat	Paraquat
	Glyphosate		Propanil
	MSMA		
	Paraquat		