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Influence of weeds of fallow rice fields on subsequent growth of rice *

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(Received November, 1973.)

INTRODUCTION

MOST rice fields when in fallow are covered abundantly with weeds which are incorporated into the soil in the course of land preparation for cultivation. The quantity of weed matter thus incorporated varies considerably depending on a number of factors, the more important of which are cropping pattern ; climatic, edaphic, and biotic influences ; and ecological characteristics of species constituting the weed population.

Application of fresh green matter to rice soils of the dry zone has been reported to be beneficial (2) and is practised in these areas to some extent, but such a practice is almost unknown in the wet-zone particularly in areas with ill-drained soils. Whether green matter is applied or not, during land preparation considerable amounts of fresh green material in the form of weed growth are incorporated into the soil and this is generally left to decompose under anarobic conditions. Planting of rice usually follows 3 to 4 weeks after, but this interval may even be shorter at times.

The ill-effects of organic manuring on rice grown under submerged, ill-drained soil conditions have been reported by many workers (3, 5, 6, 7, 8, 11). However no recognition has been made of the importance of the weed component that is incorporated into the soil, particularly in relation to harmful anaerobic decomposition products that are liberated into the soil milieu.

MATERIALS AND METHODS

Experiment I : The effects of added fresh organic matter, duration of submergence of soil before planting, and degree of soil drainage on growth of rice were studied under green-house conditions. The soils

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* Paper read before Section B (Agriculture and Forestry) of the Ceylon Association for the Advancement of Sience during the 16th Annual Sessions.

used were from the rice research stations at Bombuwela (humic and sandy soils), Panagoda and Pussellawa. Freshly harvested vegetative material of the weed *Isachne globosa O. Ktze* was used as the source of organic matter. The levels of added organic matter were 0 and 5 percent by weight of air dry soil. Duration of submergence before planting ranged from 0 to 3 weeks through one week intervals. Drainage treatments were no drainage and vertical drainage at the rate of 0.2 in. per day from the day of planting. The organic matter, drainage and duration of submergence treatments were combined factorially and replicated 4 times. Two replicates were used for determination of root growth while the other two were used to determine growth.

Four litre capacity glazed earthenware posts containing 3 kg air dry soil with provision for drainage in appropriate treatments were used. All posts received fertilizer at the rate of 1.5 gm each of concentrated superphosphate, sulphate of ammonia and muriate of potash per pot. Except for concentrated superphosphate which was given all at planting, the other fertilizers were applied in three equal doses at planting, tillering (2 weeks after planting), and primordium initiation (six weeks after planting). Twenty one day old seedlings of *Oryza sativa* L. var. H-4 and Murungakayan 302 were used for transplanting. Each pot was planted with one hill of 3 seedilngs per hill.

Experiment II: The effect of increasing levels of fresh organic matter on growth of *O. sativa* L. var. Murungakayan 302 was studied. The organic matter used was fresh material of *I. globosa*. The levels of added fresh organic matter ranged through 0 to 4 percent by weight of air dry soil. Twenty one day old rice seedlings were transplanted in 4 litre capacity earthenware pots each containing 3 kg (air dry) Bombuwela humic soil. Fertilizers were added to the soil in all pots as in Experiment I. Each pot was planted with one hill of 3 plants per hill. Organic matter additions were done one week before planting. Four replicates were planted of which two were sacrificed for sampling at the primordium initiation stage. From these 100ml of sold percolate were collected per pot and ferrous iron was determined by the O-phenanthroline method of Fortune and Mellon (4).

Experiment III: Soil percolates were collected from Bombuwela humic soil contained in earthware pots to which o. 5 and 10% fresh organic matter had been added three weeks before and the effects of the soluble decomposition products of fresh organic matter on production of new roots in 3 week old Murungakayan 302 seedlings were tested. Part of each of the percolates was distilled and each distillate

was compared with the respective percolate at equivalent volumes in respect of the effect on root production. The distillate from the 10% organic maettr treatment was treated with $NaHCO_3$ concentrated by drying under reduced pressure and chromatographed using n-butanol and 3.0 N aqueous ammonia 50/50 VV as the solvent. A o. 04% aqueous solution of Bromothymol Blue adjusted to pH 7.5 with dilute sodium hydroxide was used for colour development of the chromatogram.

RESULTS AND DISCUSSION

Effects of added fresh organic matter, duration of submergence and drainage on root development in rice

The effect of various treatments on production of new roots within a week after transplanting in H-4 and Murungakayan 302 is shown in tables 1 and 2, respectively. Added fresh organic matter drastically reduced root production in H-4 and Mrungakayan 302 and in its presence neither drainage nor period of submergence prior to planting had any beneficial effects. In the absence of added organic matter considerably more roots were produced, but drainage had hardly any effect except in Bombuwela humic soil where in the absence of drainage root production was markedly reduced, particularly in Murungakayan 302 (Table II).

Data on tiller production in Murungakayan 302 at three stages of growth—tillering phase, primordium initiation stage and two weeeks after heading—are presented in tables 3, 4 and 5. The amount of new roots produced one week after transplanting and tiller production at the three growth stages were significantly positively correlated (Table VI).

The results of this experiment revealed the deleterious effects of freshly added organic matter on growth of rice in submerged soils.

Effects of incorporation of various levels of fresh organic matter in soil on growth of rice

Incorporation of increasing levels of fresh organic matter into Bombuwela Humic soil resulted in reduced tillering in the variety Murungakayan 302 (Table VII). In treatments receiving 3 percent fresh organic matter, tillering was considerably reduced and in the 2 percent organic matter treatment tiller production was appreciably delayed. Late tillers are invariably non-productive, and as tillers form an important component of the yield constituting factors any inflence

affecting the rate of tiller production adversely will necessarily lead to a reduction in yield.

Root production was found to be reduced at levels of added organic matter of 2 per cent or more. Ferrous iron in the soil percolates was observed to increase with increase in amount of added organic matter (Table VIII).

Effects of anaerobic decomposition products of I. globosa *on root growth of rice.*

Soil percolates collected from Bombuwela Humic soil to which 0, 5 and 10 per cent fresh organic matter had been added 21 days before and left submerged were tested to determine effects on root production. With increase in amount of added organic matter root production decreased and was completely inhibited in percolates originating from the 10 per cent organic matter tratment. Distillates obtained from the respective percolates were found to have about the same ill-effects on root production as the original percolates, thus indicating that solubilised iron and other inorganic substances in the percolates were of little or no importance in retarding root production (Table IX).

The distillate obtained from the 10 per cent organic matter treatment was treated with sodium bicarbonate to convert any organic acids to their sodium salts and n-butyric acid was isolated by paper chromatography.

A number of invetigators have studied the decomposition of organic matter under anaerobic conditions. Exhaustive investigations have been carried out by Harrison and Aiyer (5, 6) on the composition of gases of swamp rice soils. The decomposition of carbohydrates in water logged soils under laboratory conditions has been studied by Subrahmanyan (10) where he noted that lactic acid was the first acid to appear but that it decomposed rapidly to form acetic and butyric acids. Acetic acid, butyric acid, Co_2 methane and small quantities of hydrogen were reported by Aachrya (1) to be the products of anaerobic decomposition of diverse plant materials inoculated with soil. This worker also noted that organic acids were produced during the first phase of decomposition and that these were subsequently decomposed. Numerous other compounds are known to be produced during anaerobic decomposition. Ammonia, carboxylic acids, amines, mercaptans and hydrogen sulphides are some of these compounds. Of these, methane is non-toxic (12) but the harmful effects of green manures on rice have been attributed to the abundant production of butyric acid under conditions of impeded drainage. Of the organic acids

produced during anaerobic decomposition of organic matter, butyric acid is stated to be the most important. It is toxic to the plant and persists in the soil under ill-drained acid conditions. Sufficient evidence is now available to prove the toxicity of butyric acid and butyrates to the rice plant (8).

Besides the production of toxic organic compounds, actively decomposing organic matter has a considerable influence in lowering the redox potentials of soils. A low redox potential *per se* may not have an adverse effect on the rice plant but such a condition may influence considerably the liberation of iron and manganese into the soil solution in concentrations toxic to rice plants (9). Addition of increasing levels of organic matter had the effect of liberating large quantities of ferrous iron (Table VIII) and root production was strikingly affected with increase in added organic matter. However, comparison of root production in the distilled and undistilled percolates showed no appreciable difference, suggesting that the organic compounds liberated are of considerably greater importance in inhibiting root development than substances of inorganic nature liberated into the soil solution during anaerobic decomposition of organic matter.

Butyric acid was isolated chromatographically as one of the products of anaerobic decomposition. This compound is a known respiratory inhibitor and could adversely affect the mechanisms of selective on absorption in roots and thereby lead to a nutritionally impoverished plant resulting from a physiologically inactive root system. Tests carried out with authentic butyric acid at concentrations found in the soil solution did not have such drastic effects on root production as the soil solution. This suggests the presence of other substances liberated during anaerobic decomposition of organic matter which are possibly more toxic to root development and root activity than n-butyric acid.

Easily decomposable organic matter in soils under ill-drained conditions appears to be responsible for bringing about unfavourable conditions for rice growth. Weed growth incorporated in the soil during land preparatio nprior to cultivation constitutes an important source of easily decomposable organic matter. A considerable improvement in rice growth under ill-drained submerged soil conditions should be possible if the incorporation of weeds in an easily decomposable form could be avoided at the time of cultivation. The use of pre-plant applications of total weedkilers may have application in minimizing the deleterious effects of weeds incorporated into ill-drained soils.

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Table 1.—Effect of added fresh organic matter, drainage, and duration of soil submergence on root production in H4[1]

Soil	*Panagoda*				*Pussellawa*				*Bombuwela Humic*				*Bomubuwela Sandy*			
Duration of submergence before planting	+OM[2]		−OM		+OM		−OM		+OM		−OM		+OM		−OM	
	+D[3]	−D	+D	−D	+D	−D	+D	−D	+D	−D	+D	−D	+D	−D	+D	−D
0 days ..	0.1	0	9.2	3.7	4.4	0.5	18.0	7.6	0	0	6.4	4.5	0	0	5.5	5.3
7 days ..	0	0	0.1	8.2	0	0	22.4	34.7	0	0	4.3	3.4	0	0	2.3	4.2
14 days ..	0.1	0	2.5	2.2	0	0	13.6	24.7	0	0	6.3	0.6	0	0	3.8	7.6
21 days ..	3.6	0	3.3	0.8	0	0	13.2	9.7	0	0	4.6	7.9	0	1.0	3.7	12.0

(1) Values reported are mean dry weights of roots produced per hill of 3 seedlings in mg.

(2) +OM and −OM are 5 per cent fresh organic matter added to air dry soil and none added, respectively.

(3) +D and −D are drained and undrained, respectively.

Table II.—Effect of added fresh organic matter, drainage, and duration of soil submergence on root production in Murungakayan 302[1]

Soil	*Panagoda*				*Pussellawa*				*Bombuwela Humic*				*Bombuwela Sandy*			
Duration of submergence before planting	+OM[2]		—OM		+OM		—OM		+OM		—OM		+OM		—OM	
	+D[2]	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D
0 days ..	2.0	0	5.8	11.3	4.3	0.9	12.7	6.7	0	0	5.6	3.3	2.0	0.4	6.5	5.3
7 days ..	0	0	6.9	7.5	0	0	8.7	9.0	0	0	7.7	0.8	0.3	0	4.4	3.3
14 days ..	0.6	0.4	10.5	4.1	0.4	0.9	11.1	9.8	0	0	5.2	0.7	1.8	0	4.4	4.8
21 days ..	2.5	0	12.1	8.8	3.7	1.8	5.1	12.1	4.8	0	3.1	0.9	0	2.3	5.4	12.3

(1) Values reported are mean dry weights of roots produced per hill of 3 seedlings in mg.

(2) +OM and —OM are 5 percent fresh organic matter added to air dry soil and none added, respectively.

(3) +D and —D are drained and undrained, respectively.

Table III.—Effect of added fresh organic matter, drainage, and duration of soil submergence on the number of tillers per hill at tillering phase in Murungakayan 302[1]

Soil	*Panagoda*				*Pusse.llawa*				*Bombuwela Humic*				*Bombuwela Sandy*			
Duration of submergence before planting	+OM[2]		—OM		+OM		—OM		+OM		—OM		+OM		—OM	
	+D[3]	—D	+D	—D	—D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D
0 days ..	1.5	0	13.0	11.5	5.5	2.0	7.0	6.5	1.5	0	11.0	9.5	3.0	0	13.5	10.0
7days ..	0	0	15.5	14.0	0	0	6.5	6.5	0	0	12.0	10.0	0	0	16.5	9.5
14 days ..	4.0	1.5	14.0	11.5	0	0	9.0	6.0	0	0	13.5	5.0	0.5	0	14.5	12.0
21 days ..	8.5	0	15.0	12.5	4.0	2.5	7.0	7.0	10.0	0	10.5	9.0	3.5	0.5	11.5	9.5

(1) Mean of two replicates.

(2) and (3) same same as in table I.

Table IV.—Effect of added fresh organic matter, drainage, and duration of soil submergence on the number of tillers per hill at primordium iniation stage in Murungakayan 302[1]

Soil	*Panagoda*				*pussellawa*				*Bombuwela Humic*				*Bombuwela Sandy*			
Duration of submergence before planting	+OM[2]		—OM		+OM		—OM		+OM		—OM		+OM		—OM	
	+D[3]	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D
0 days ..	6.5	0	20.0	19.0	13.5	1.0	11.5	10.5	6.0	0	17.5	17.0	8.5	0	19.0	17.5
7 days ..	0	0	23.0	25.0	0	0	10.0	11.0	0	0	20.0	13.5	0	0	18.0	19.5
14 days ..	7.5	7.5	22.0	23.5	0	0	10.0	11.0	0	0	21.5	9.5	0	0	16.5	21.0
21 days ..	18.5	0	21.0	23.0	8.0	4.0	13.5	10.0	22.5	0	18.0	12.5	9.0	3.5	17.5	18.0

([1]) Mean of two replicates.

([2]) and ([3]) same as in table I.

Table V.—Effect of added fresh organic matter, drainage, and duration of soil submergence on the number of tillers per hill two weeks after heading in Murungakayan 302[1]

Soil	*Panagoda*				*Pussellawa*				*Bombuwela Humic*				*Bombuwela Sandy*			
Duration of submergence before planting	+OM[2]		—OM		+OM		—OM		+OM		—OM		+OM		—OM	
	+D[3]	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D	+D	—D
0 days ..	7.5	0	14.0	14.0	13.5	1.5	9.0	11.0	4.5	0	12.0	12.0	7.0	12.5	12.5	9.5
7 days ..	0	0	13.0	17.5	0	0	9.5	11.0	0	0	11.5	8.5	0	0	11.5	7.0
14 days ..	5.0	6.0	13.5	16.5	0	0	9.0	10.5	0	0	11.5	7.0	0	0	11.0	7.5
21 days ..	12.0	0	12.0	17.0	8	4	9.5	10.0	13.5	0	11.0	7.0	8.0	4	10.0	8.5

([1]) Mean of two replicates.

([2]) and ([3]) same as in table I.

TABLE VI.—Correlation between dry weight of roots produced one week after transplanting and tiller production at different growth stages in Murungakayan 302

Growth Stage / *Soil Type*	*Tillering phase*	*Primordium Initiation stage*	*Two weeks after heading*
Panagoda	0·899 xxx	0.839 xxx	0·805 xxx
Pussellawa ..	0·883 xxx	0·765 xxx	0·763 xxx
Bombuwela Humic ..	0·833 xxx	0·863 xxx	0·839 xxx
Bombuwela Sandy ..	0·685 xx	0·741 xx	0·661 xx

xx, xxx Significant at 1 % and 0.1 % level of probability, respectively.

TABLE VII.—Effect of different levels of added organic matter on tiller production in Murungakayan 302[1]

Added organic matter (%)	*Tillers produced per hill*		
	Three weeks after planting	*Five weeks after planting*	*Six weeks after planting (P.I. stage)*
0·0	5·5	11·0	11·0
0·5	3·5	10·0	10·0
1·0	4·5	11·0	11·0
2·0	3·0	8·0	12·0
3·0	3·5	7·0	9·0

[1] Mean of two replicates.

TABLE VIII.—Effect of different levels of added organic matter on root production in Murungakayan 302 and ferrous iron content in soil solution

Added organic matter (%)	*Six weeks after planting (P.I. stage)*	
	Dry weight of roots (mg/hill)	*Ferrous iron in soil solution (ppm)*
0·0	75·2	185
0·5	88·6	270
1·0	86·8	370
2·0	62·4	480
3·0	47·7	555
4·0	39·5	540

TABLE IX.—Comparison of the effects of soil percolates and distilled percolates from different organic matter levels on root production in Murungakayan 302

Added organic matter (%)	*Dry weight of roots in mg*	
	Soil percolate	*Distilled soil percolate*
0·0	8·7	8·2
5·0	3·6	3·4
10·0	0·0	0·0

New chemicals for the control of rice weeds

I. Weed control in broadcast rice

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(Received November, 1973)

INTRODUCTION

Emulsifiable concentrates (EC) of 3, 4-dichloropropionanilide (3, 4-DPA), 2-methly 4-chlorophenoxyacetic acid (MCPA) and pentachlorophenol (PCP) ; granular formulations of PCP ; and wettable powder (WP) formulations of Linuron are the forms and kinds of selective weedicides in current use for weed control in rice in Sri Lanka. Except for WP formulations of Linuron, hitherto used in transplanted rice as a soil or sand mix (1), and PCP granules (G) used specifically in lowland rice, the other chemical formulations are of general application under varied types of rice cultivation (2).

From about 1969 a number of new weedicides were tested for their suitability in broadcast rice. Emphasis was given to finding new chemicals for this method of cultivation as most of the Island's rice is grown as a broadcast crop. Granular formulations received greater attention in these investigations because of their ease of application vis-a-vis EC and WP formulations (3).

This paper deals with the results of experiments conducted, during 5 crop seasons from Maha 1969/70 through Maha 71/72 in broadcast lowland wet-sown and lowland dry-sown rice, in a number of research stations located in the main agro-climatic regions of the country.

MATERIALS AND METHODS

Newly bred high yielding dwarf to semi-dwarf rice varieties, with the exception of H4, were grown in these tests adopting standard methods of management—in respect of land preparation, water usage, plant population density, fertilization, and pest and disease control—normally practised under the two cultivation systems. Schedule A given below shows the varieties grown, location, and details of the kinds, amounts and times of fertilizer application followed in the various experiments.

Schedule A

Broadcast Sown Lowland Rice

Experiment/Cultivation Method	*Season*	*Location*	*Variety*	*Nutrients*	*Pounds nutrients applied per acre at*					
					Sowing	*2 + WAS*	*3 WAS*	*5 WAS*	*6 WAS*	*10 WAS*
1. Broadcast Wet-sown ..	Maha 69/70	cf table II	cf table II	N	—	—	30	—	60	30
				P_2O_5	80	—	—	—	—	—
				K_2O	40	—	—	—	—	40
2. Broadcast Wet-sown ..	Yala 1970	Nalanda	LD 66	do.						
3. Broadcast Wet-sown ..	Maha 70/71	Nalanda	Bg 11–11							
4. Broadcast Wet-sown ..	Maha 70/71	Nalanda	Bg 11–11	N	—	30	—	—	60	30
				P_2O_5	80	—	—	—	—	—
				K_2O	40	—	—	—	40	—
5. Broadcast Wet-sown ..	Maha 70/71	Nalanda	Bg 11–11	do.						
6. Broadcast Wet-sown ..	Yala 1971	Nalanda	Bg 11–11							
7. Broadcast Wet-sown ..	Maha 71/72	Nalanda	Bg 11–11	N	4.5	12.8	—	—	12.8	38.4
				P_2O_5	45	—	—	—	—	—
				K_2O	22.6	—	—	—	—	—
8. Broadcast Wet-sown ..	Maha 71/72	Nalanda	Bg 11–11	do.						
9. Broadcast Dry-sown ..	Maha 71/72	Pelwehera	H-4							

+ WAS = Weeks after sowing.

RESULTS AND DISCUSSION

Broadcast Lowland and Wet-sown Rice.—In a uniform weed control (UWC) experiment conducted in Maha 69/70 in 8 locations—3 in the dry zone, 1 in the intermediate zone and 4 in the wet zone—none of the weedicide treatments (Table 1) gave yields superior to the hand-weeded control (Table 2). However, Machete EC at 2 lb. a.i. per acre, MCPA G, Linuron G, Chloroxuron WP, 34-DPA EC and PCP G were comparable to the handweeded treatment at Maha-Illuppallama ; MCPA G, Linuron G, Chloroxuron WP, 3,4-DPA EC and PCP G were comparable to the handweeded treatment at Karadian Aru ; Machete EC (applied either as in treatment 1 or 3 in Table), Ramrod G, Linuron G, Chloroxuron WP, 3, 4-DPA EC and PCP G were comparable to the handweeded treatment at Nalanda, the intermediate zone station ; and Machete EC (applied either as in treatment 1 or 3 in Table 1), MCPA G, Linuron G, Chloroxuron WP, 3,4-DPA EC and PCP G were comparable to the handweeded treatment at Labuduwa in the wet zone.

Linuron G, Machete EC, Chloroxuron WP and MCPA G were the new chemicals/formulations that performed consistently well in this multilocation test. Some of the weedicides were phytotoxic to rice (Table 3). Machete at 3 lb. a.i. per acre when applied to a puddled field just before seeding or at second ploughing, which was done 7 days before seeding, caused severe damage to the rice seedlings but the rice plants recovered from these ill-effects with time, particularly in the latter treatment. The effects of Ramrod G were even more drastic and led to the complete elimination of stands in some instances while in general recovery of rice plants from the ill-effects of this chemical was poor. Invariably where high yields were obtained with new weedicides the weed control was good (cf Tables 2 and4).

On the basis of further tests done with new weedicides/formulations a number of these were found to be promising. Linuron G, Treflan-R G, and TOK G (Table 5) ; Saturn G (Tables 6 and 9) ; Nitralin/ MCPA-Na G (Table 6) ; Machete G (Tables 6, 7, 9 and 11), and Machete/2,4-D BE * G (Table 6) ; NTN 5006/2, 4-D IPE ** G (Tables 6, 9 and 11) ; MO 9 G (Table 7) 2, 4-D IPE G (Table 8) ; C-288 G and C-290 G (Table 9) ; Bladex WP and VCS 438 WP (Table 10) ; and Sencor WP (Table 10 and 11) gave yields comparable to the hand-weeded tratment in the respective tests.

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* *BE Butyl ester*
** *IPE Isopropyl ester*

Considering their ease of application, low phytotoxicity to rice in terms of visual symptoms and stand establishment, and high efficacy of weed control Linuron G, Machete G, Saturn G, 2, 4-D IPE G and MCPA G can be considered as very promising new weedicides/formulations. These have been tested adequately and the results provide sufficient information on the rates, times and methods of application best suited for their use. New weedicides that merit further testing are Treflan-R, TOK, Nitralin/MCPA-Na Machete/2, 4-D BE, MO 9, C-288, C-290, Bladex, VCS 438 and Sencor. NTN 5006/2, 4-D IPE, although promising, is not being formulated due to toxicological reasons.

Broadcast Lowland Dry-sown Rice.—A fair proportion of the Island's rice extent is broadcast dry-sown during the two main cropping seasons—Yala and Maha—of the year. Low yields are a characteristic feature of this type of cultivation and hardly any improvement has resulted even with the spread of new improved rice varieties into these areas. The primary reason for low productivity undre broadcast dry-sown conditions is heavy weed infestations leading to poor stands of rice and eventual low yields. While the old improved types of rice varieties could compete with weeds somewhat, the new improved types because of their short stature are very vulnerable in this respect and the need for adequate weed control has assumed even greater importance than before for dry-sown rice.

A number of new chemicals were tested under broadcast lowland dry-sown conditions. Machete G applied at 2 lb. a.i. per acre immediately after seeding and harrowing gave yields superior to the hand-weeded control in an experiment conducted during Maha 71/72. Machete G applied in this manner did not affect the stand adversely, was not phytotoxic to the rice plants, and controlled weeds reasonably well (Table 12). EC formulations of Machete sprayed with the onset of the first rains after seeding at rates of 2 and 3 lb. a.i. per acre gave yields comparable to the granular formulation of the weedicide. However, under dry-sown conditions, due to reasons such as scarcity of water during seeding and rains of increasing intensity for some time from seeding, a granular formulation that can be applied at about seeding has decided advantages over EC formulations.

CONCLUSIONS

A number of new weedicides/formulations were tested and found to be suitable for the control of weeds in broadcast rice. Their acceptance by users will depend *inter alia* on the cost of these chemicals. The rates, methods and times of application to be followed in the use of these chemicals under broadcast lowland wet-sown and dry-sown conditions are scheduled below :

Broadcast Lowland Wet-sown Rice

Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method and time of application*
Machete*	G	0.9 to 1.0	Apply to 1-2 inch water, preferably with water submerging the weeds, at 6-7 days after seeding. Could be used as a pre-sowing application where 2 lb. a.i. per acre granules are applied to puddled and levelled field 5 days before seeding of rice. Soil surface should be disturbed to a minimum at sowing if this method is adopted. EC formulations could be used at same rates of active ingredient
MCPA*	G	0.75	Apply to 1-2 inch water at 6–7 days after seeding
Linuren*	G	0.25	Apply to 1-2 inch water at 6–7 days after seeding
Saturn* ..	G	1.3 to 1.8	Apply to 1-2 inch water at 6–7 days after seeding
2, 4 D IPE*	G	0.75	Apply to 1-2 inch water at 6–7 days after seding
Traflan-R**	G	0.7/0.8	do.
TOK**	G	2.0	do.
Nitralin/MCPA**	G	1.08/0.45	do.
Machete/2, 4D BE**	G	0.90/0.45	do.
MO 9**	G	3.0	Apply 5 days before seeding as for Machete G
C*288** ..	G	0.9	Apply to 1-2 inch water 6 days after seeding
C*290** ..	G	0.9	do.

* Sufficiently tested

** Merits further testing.

Broadcast Lowland Wet-sown Rice (Contd.)

Weedicide	*Formuvation*	*Rate lb.a.i per acre*	*Method and time of application*
Sencor**	.. WP ..	0.5 ..	Apply as 'soil-mix' to puddled and levelled field 7 days before seeding and seed with minimum disturbance of soil surface or to 1-2 inch water 6-7 days after seeding
Bladex**	.. WP ..	1.5 ..	Apply as 'soil-mix' to puddled and levelled field 7 days before seding with minimum disturbance of soil surface
VCS**	.. WP ..	0.75 ..	Same as a above but apply 5 days before seeding
Broadcast Lowland Dry-Sown Rice			
Machete**	.. G ..	2.0 ..	Apply immediately after seeding and harrowing

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** Merits further testing.

Table I.—Treatments in Uniform Weed Control (UWC) Experiment 1 with broadcast rice

Treatment	*Weedicide and formulation*	*Rate lb a.i. Perac.*	*Method and time of weedicide application*
1	Machete EC*	2.0	Sprayed into drained field 7 DAS‡
2	Machete EC	3.0	Sprayed into drained field immediately before puddling and levelling
3	Machete EC	3.0	Sprayed at second ploughing
4	Ramrod G	2.0	Applied into 1 inch standing water 5 DAS
5	MCPA G	0.75	Applied into 1 inch standing water 7 DAS
6	Linuron G	0.25	do.
7	Chloroxuron WP	1.0	Applied into 1 inch standing water as 'soil mix' 7 DAS
8	3, 4-DPA EC	3.0	Sprayed into drained field at 2-3 leaf stage of weeds and water impounded 3 days later
9	PCP G	8.0	Applied into 1-2 linches of water 7 DAS
10	Unweeded Control	—	—
11	Handweeded Control	—	Handweeded 21 and 42 DAS
12	Unweeded Control†	—	—

* EC—Emulsifiable concentrate ; G=Granules ; WP=Wettable Powder

†Weed seeds not added ; all other treatments received 5 gm weed seeds per plot at second ploughing.

‡DAS=Days after seeding

Table II.—Effect of weedicide application on grain yield of rice in UWC experiment 1

Treatment/Weedicide	*Location and Rice variety*									
	Maha Illuppallama Bg11-11	*Karadian Aru* IR-8	*Ambalantota* Bg 11-11	*Mean Dry zone*	*Nalanda* IR-8	*Peradeniya* IR-8	*Bombuwela* PD 46A	*Karapincha* LD-65	*Labu duwa* LD-65	*Mean Wet zone*
1. Machete ..	122.5* 6178 †	10.9 550	69.0 3480	67.5 3404	53.9 2718	83.6 4216	57.3 2890	22.4 1130	43.1 2174	51.6 2602
2. Machete ..	24.8 1251	3.0 151	56.4 2845	28.1 1417	‡	68.5 3456	57.7 2910	20.8 1049	21.6 1089	42.1 2123
3. Machete ..	80.5 4060	11.3 570	77.5 3909	56.4 2845	70.2 3541	72.7 3667	59.2 2986	18.7 943	32.1 1619	45.7 2305
4. Ramrod ..	39.2 1977	4.5 227	‡	14.6 736	95.1 4796	83.7 4221	46.0 2320	19.5 983	17.7 893	41.7 2103
5. MCPA ..	127.3 6420	31.1 1594	76.1 3838	78.3 3949	50.2 2532	99.0 4993	61.8 3117	21.0 1059	41.7 2103	55.9 2819
6. Linuron ..	125.0 6304	28.1 1417	67.4 3399	73.5 3707	90.7 4574	83.6 4216	55.9 2819	26.8 1352	33.1 1669	49.8 2512
7. Chloroxuron ..	115.9 5845	28.5 1437	77.9 3929	74.1 3737	77.3 3899	89.9 4534	59.8 3016	17.5 883	46.7 2355	53.5 2698
8. 3, 4-DPA ..	127.8 6446	23.7 1195	79.0 3984	76.8 3873	95.6 4822	86.5 4363	58.5 2950	17.4 878	43.1 2174	51.4 2592
9. PCP	116.3 5866	27.6 1392	75.9 3828	73.3 3697	75.1 3788	95.3 4807	57.2 2885	17.8 898	39.3 1982	52.4 2643
10. Unweeded control ..	95.0 4791	24.5 1236	55.7 2809	58.4 2945	66.7 3364	106.3 5361	58.5 2950	13.7 691	30.0 1513	52.1 2628
11. Handweeded control ..	130.7 6592	28.6 1442	82.3 4151	80.5 4060	81.9 4131	80.5 4060	59.2 2986	21.1 1064	41.2 2078	50.5 2547
12. Unweeded control ..	89.2 4499	31.7 1598	69.6 3510	63.5 3203	61.1 3082	122.4 6173	53.3 2688	25.0 1261	27.6 1392	57.1 2880
L.S.D. (0.05) ..	18.9 953	7.8 393	NS	—	29.0 1463	NS	NS	NS	12.1 610	—
C.V. % ..	11.2	21.7	14.6	—	22.8	29.6	14.0	38.1	20.7	—

* Yield in bu/ac

†† a Yields in kg/ha

‡ No stand due to severe phytotoxicity

TABLE III.—Visual phytotoxicity ratings of weedicides on rice plants two weeks after application in UWC experiment

Treatment/Weedicide	*Location and Rice Variety*									
	Maha Illup-pallama Bg 11-11	*Kara-dian Aru* IR 8	*Amba-lantota* Bg 11-11	*Mean Dry Zone*	*Nalanda* IR 8	*Pera-deniya* IR 8	*Bombu-wela* PD 46 A	*Kara-pincha* LD 65	*Labu duwa* LD 65	*Mean Wet Zone*
1. Machete ..	0.0	3.3	2.0	1.8	2.3	2.7	2.5	2.0	1.3	2.1
2. Machete ..	5.0	5.0	4.0	4.7	5.0	5.0	4.5	5.0	3.0	4.4
3. Machete ..	4.0	5.0	3.0	4.0	2.0	1.7	1.7	3.0	1.0	1.8
4. Ramrod ..	3.0	5.0	5.0	4.3	3.3	3.3	2.3	4.0	2.0	2.9
5. MCPA ..	0.0	1.7	3.0	1.6	2.0	2.0	2.0	2.0	1.0	1.7
6. Linuron ..	0.0	0.0	3.0	1.0	1.7	1.7	0.7	3.0	0.3	1.4
7. Chloroxuron ..	0.3	1.3	2.0	1.2	3.0	3.0	0.7	3.0	1.0	1.9
8. 3, 4-DPA ..	0.0	0.0	0.0	0.0	3.0	3.0	0.2	0.0	0.0	0.8
9. PCP ..	1.0	1.0	3.0	1.7	2.0	1.7	0.7	3.0	0.0	1.3
10. Unweeded Control ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11. Handweeded Control ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12. Unweeded Control ..	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

* 0–5 scale used where 0 is no toxicity and 5 high toxicity

TABLE IV—Effect of weedicides on weed growth (dry weight in gm) in UWC experiment 1*

Treatment/Weedicide	Location and Rice Variety									
	Maha-Illup-pallama Bg 11-11	*Kara-dian Aru* IR 8	*Amba-lan-tota* Bg 11-11	*Mean Dry Zone*	*Nalanda* IR 8	*Pera-deniya* IR 8	*Bombu-wela* PD 46A	*Kara-pincha* LD 65	*Labu-duwa* LD 65	*Mean Wet Zone*
1. Machete ..	15.5	30.7	343.3	129.8	153.0	70.3	52.3	52.1	33.0	51.9
2. Machete ..	58.9	181.6	336.6	192.4	414.0	14.3	126.5	52.1	56.6	62.4
3. Machete ..	16.6	219.3	130.0	122.0	88.3	14.3	96.0	46.8	56.6	53.4
4. Ramrod ..	56.1	207.5	633.3	299.0	103.7	20.6	360.7	68.0	92.0	135.3
5. MCPA ..	17.8	21.2	123.3	54.1	97.3	67.0	114.0	87.8	51.9	80.2
6. Linuron ..	11.3	35.4	233.3	93.3	39.3	53.0	45.0	45.3	44.8	47.0
7. Chloroxuron ..	19.3	21.2	96.6	45.7	57.0	55.0	44.1	53.9	44.8	49.4
8. 3, 4-DPA ..	7.8	16.3	86.6	37.0	108.7	18.6	101.5	56.7	51.9	57.2
9. PCP ..	17.9	21.2	83.3	40.8	42.3	22.6	48.8	50.0	47.2	42.1
10. Unweeded Control ..	65.8	44.8	140.0	83.5	205.0	104.3	144.8	52.8	82.5	96.1
11. Handweeded Control ..	0.0	21.2	20.0	13.7	69.7	29.3	77.6	51.1	44.8	50.7
12. Unweeded Control ..	76.6	33.0	93.3	67.6	154.3	107.0	152.8	74.8	84.9	104.9

* Dry weight of weeds of 4 quadrats each of size 1 × 2 sq ft. taken just before harvest of rice

TABLE V.—Weedicide experiment 2 with broadcast wet-sown rice

Treatment/ Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method & time of weedicide application*	*Visual weed control ratings*		*Visual phytotoxicity rating ‖*		*@ Dry weight of weeds per 8 sq. ft in gm*	*Grain Yield ¶*	
				14 DAS	21 DAS	14 DAS	21 DAS		*bu/ac*	*kg/ha*
1. Machete ..	5% G*	2.0	Applied into 1" standing water 10 DAS ‡	2.0	2.0	2.7	1.7	234.0	77.0	3884
2. Machete ..	5% G	2.0	Applied into flooded soil 5 DBS	1.0	3.0	1.0	1.0	282.0	83.2	4196
3. Linuron ..	1.5% G	0.25	Applied into 1–2" standing water 7 DAS	1.3	1.0	2.3	1.0	170.7	96.7	4877
4. 2, 4–D IPE ..	3% G	0.75	do.	1.0	1.0	2.7	1.0	265.0	83.5	4211
5. Treblan-R ..	2.8%G/ 3% G	0.7/0.8	do.	2.0	1.0	3.0	1.3	106.7	90.2	4549
6. Chemrice ..	10% G	3.0	do.	2.3	2.3	1.0	1.0	208.3	79.6	4015
7. Swep ..	20% G	3.0	do.	1.3	1.0	2.7	1.0	263.3	86.6	4368
8. TCK ..	7% G	2.0	do.	1.0	1.0	1.7	1.0	223.0	92.7	4675
9. 3,4–DPA foll: by MCPA	36%/ 40%EC	3.0/0.75	Applied 3, 4–DPA 14 DAS & MCPA 25 DAS	3.3	2.3	2.0	1.0	148.3	84.9	4282
10. Unweeded control†	—	—	—	4.3	4.0	0.0	0.0	199.7	88.3	4453
11. Unweeded control	—	—	—	5.0	4.7	0.0	0.0	569.0	49.9	2517
12. Handweeded control	—	—	Handweeded 21 & 42 DAS	5.0	1.3	0.0	0.0	—	107.5	5422

* G=Granules, EC=Emulsifiable concentrate † Weed seeds not added to this treatment ; all other treatment received 5 gm. weed seeds per plot at seeding. ‡ DAS=Days after seeding and DBS is days before seeding. § 0–5 scale used where 0 is good control and 5 is poor control. ‖ 0–5 scale used where 0 is no toxicity & 5 high toxicity. ¶ Ca-efficient of variation percent 13.3 ; LSD (0.05)=19.0 bu/ac and 958 kg/ha @ Weed weight taken just before harvest.

TABLE VI.—Weedicide experiment 3 with granular weedicides on broadcast wet-sown rice (Co-operative Experiment with IRRI)

Treatment/ Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method & time of weedicide application*	*Stand counts in 9 sq· ft.*				*Visual weed control rating at 70*	*Phyto-toxicity rating at 25*	*Dry Wt. of weeds per 4 sq· ft. in gm*	*Grain Yield ¶*	
				RICE		*WEEDS*						
				1 DBA §	25 DAS	1 DBA	25 DAS	DAS‖	DAS@		*bu/ac*	*kg/ha*
1. Saturn* ..	10% G†	1.8	Applied intp 1" water 6 DAS‡	214·0	124.2	89.0	4.2	6.5	2.2	47.2	127·9	6451
2. TCE–Styrene/ 2, 4–D IPE	3%/2%G	0.54/ 0.36	Applied into 1" water 10 DAS	280.2	220.7	66.7	9.7	4.5	2·0	54.5	99.2	5008
3. Nitralin MCPA–Na	4% 1.8% G	1.08/ 0.45	Applied into 1" water 6 DAS	257.7	209.7	96.7	5.0	5.5	3.2	31.5	118.3	5967
4. Machete	5% G	0.90	Applied in to 1" water 8 DAS	261.2	8.65	55.5	3.0	7.7	7.7	22.7	121.9	6148
5. Machete/2, 4 D BE	3.33% 1.67% G	0.90/ 0.45	do.	258.7	130.5	54.5	2·5	5.5	7.5	35.0	118.9	5997
6. NTN 5006/ 2, 4–D IPE	7%/ 1.5%G	1.80/ 0.41	Applied into 1" water 6 DAS	321.7	222.7	101.5	0.7	8.2	5.0	33.2	125.5	6330
7. Unweeded control	—	—		277.2	249.0	63.7	32.5	1.0	1.0	87.5	84.8	4277
8. Handweeded control	—	—	Handweeded 21 and 42 DAS	269.0	249.0	75.2	48.0	10.0	1.0	—	129.5	6531

* 10 gm weed seeds added to each treatment immediately after seeding with the rice. † G=gtanules. ‡ DAS—Days after seeding

§ 1 DBA—One day before application of weedicide.

‖ Baseed on 1–10 scale where 1 is poor control and 10 is good control and measurements done at heading stage of grassy weeds.

= Based on 1–10 scale where 1 is no toxicity and 10 is high toxicity

¶ Co-efficient of variation percent=9.9 ; LSD (0.05)16.8 bu/ac and 847 kg/ha

TABLE VII.—Weedicide experiment 4 with pre-sowing application of granular weedicides in broadcast wet-sown rice

Treatment/Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method and time of weedicide application*	*Visual phyto-toxicity rating at 25 DAS§*	*Dry weight of weeds per 8 sq ft in gm‖*	*Grain Yield ¶*	
						bu/ac	*kg/ha*
1. Machete* ..	5%G †	1.0	Applied to puddled surface 3 DBS ‡	4.5	27.0	101.2	5104
2. Machete ..	5% G	2.0	Applied to puddled surface 5 DBS	6.7	30.2	110.1	5553
3. Swep ..	20% G	3.0	do.	7.2	40.2	103.1	5200
4. Mo 9 ..	9% G	3.0	do.	5.2	22.7	110.1	5553
5. PCP ..	16% G	8.0	do.	5.2	39.5	108.0	5447
6. PCP ..	16% G	8.0	Applied into 1 inch water 7 DAS	3.2	50.2	106.8	5387
7. Unweed Control ..	—	—	—	1.0	70.2	102.1	5149
8. Hand weeded Control..	—	—	Handweeded 21 and 42 DAS	1.0	—	113.4	5719

* 5 gm weed seeds applied to all plots at puddling.
† G–Granules
‡ DBS=Days before seeding and DAS is days after seeding.
§ Based on 1–10 scale where 1 is no toxicity and 10 is high toxicity.
‖ Just before harvest.
¶ Coefficient of variation percent=3.6 ; LSD (0.05)=5.7 bu/ac and 287 kg/ha

TABLE. VIII.—Weedicide experiment 5 with broadcast wet-sown rice

Treatment/Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method and time of weedicide application*	*Visuql phyto-toxicity rating at 7 DAA §*	*Dry weight of weeds per 8 sq. ft. in gm. ‖*	*Grain Yield¶*	
						bu/ac/	*kg/ha*
1. Machete ..	5%G†	1.0	Applied to 1-2 inch water 14 DAS ‡	1.0	244.7	84.3	4252
2. Treflan-R ..	1.6%/ 2.3%G	0.35/ 0.40	do. 14 DAS	1.3	263.7	67.1	3384
3. Chem Rice ..	10%G	3.0	do. 7 DAS	0.0	123.3	71.0	3581
4. 2, 4-D IPE ..	3%G	0.75	do. 7 DAS	3.3	242.7	92.2	4650
5. Swep ..	20%G	3.0	do. 7 DAS	1.0	169.7	85.7	4322
6. TOK ..	7%G	2.0	do. 7 DAS	1.0	206.3	81.5	4110
7. Linuron ..	1.5%G	0.25	do. 7 DAS	1.7	217.7	70.7	3566
8. Chloroxuron ..	50%WP	1.0	Applied into 1-2 inch water as soil mix 7 DAS	1.0	367.3	63.9	3223
9. 3, 4-DPA followed by MCPA	36%/ 40%EC	3.0/ 0.75	Sprayed 14 and 21 DAS, respectively	4.0	94.0	92,7	4675
10. Unweeded control *..	—	—	—	0.0	326.0	63.6	3208
11. Unweeded control ..	—	—	—	0.0	353.0	57.4	2895
12. Handweeded control	—	—	Handweeded 21 and 42 DAS	0.0	—	105.3	5311

* Weed seeds not added to this treatment ; all others received 5 gm weed seeds per plot immediately after seeding
† G=Granules ; WP=Wettable powder and EC=Emulsifiale cioncentrate
‡ DAS=Days after seeding
§ DAA=Days after application of weedicide based on 0.5 scale where 0 is no toxicity and 5 is high toxicity
‖ Just before harvest
¶ Coefficient of variation percent=12.9 ; LSD (0.05)=17.1 bu/ac and 862 kg/ha

TABLE IX.—Weedicide experiment 6 with granular weedicides on broadcast wet-sown rice (Co-operative experiment with IRRI)

Treatment/ Weedicide	Formulation	Rate lb. a.i. per acre	Method and time of weedicide application	Stand count in 9 sq. ft.				Visual§ weed control rating at 90 DAS	Visual phytotoxicity rating at 30 DAS	Dry‖ weight of weeds per 4 sq. ft. in gm.	Grain¶ yield‡	
				Rice		Weeds						
				1 DBA	25 DAS	1 DBA	25 DAS				bu/ac	kg/ha
1. Saturn* ..	10%G†	1.3	Applied to 1-2 inch water 6 DAS**	425.5	392.5	83.0	10.0	6.0	3.0	47.8	73.9	3727
2. Machete ..	5%G	0.9	do.	431.5	395.0	123.5	4.5	9.0	1.0	46.0	73.9	3727
3. NTN 5006/ 2,4–D IPE	7%/ 1.5G	1.80/ 0.41	do.	405.7	383.5	105.2	9.7	8.2	4.0	21.2	74.8	3773
4. TCE Styrene 2, 2,4–D IPE	3%/ 2%G	0.54/ 0.36	Applied to 1–2 inch water 10 DAS	326.2	325.0	122.5	114.5	1.8	1.0	149.3	41.2	2078
5. C-288 ..	7.5%G	0.9	Applied to 1–2 inch water 6 DAS	430.7	390.0	145.7	10.0	7.5	1.0	35.4	74.8	3773
6. C–290 ..	7.5%G	0.9	do.	447.2	403.0	126.0	15.5	5.5	1.0	56.9	58.0	2925
7. Unweeded control	—	—	—	392.2	353.7	135.0	178.5	1.0	1.0	203.4	31.1	1568
8. Handweeded control	—	—	Handweeded 21 and 42 DAS	413.2	420.0	129.5	—	10.0	1.0	—	60.5	3051

* 8 gm weed seeds added per plot immediately after seeding rice. † G=Granules. ‡ Based on 1–10 scale where 1 is poor control and 10 is good control. § Based on 1–5 scale where 1 is no toxicity and 5 is high toxicity ‖ Just before harvest· ¶ Coefficient of variation percent=15.5 ; LSD (0.05)=13.9 bu/ac and 701 kg/ha. ** DAS=Days after seeding and DBA= days before application.

TABLE X.—Weedicide experiment 7 with pre-sowing application of weedicides on broadcast wet-sowne rice

Treatment/ Weedicide	*Formulation*	*Rate lb. a.i. per acre*	*Method and time of weedicide application*	*Stand counts per sq. ft. at 25 DAS*		*Visual weed control rarting §*		*Visual Phyto-toxicity trating ‖*		*Dry ** Weight of weeds per sq. ft. in gm*	*Grain Yield*	
				Weeds	*Rice*	*25 DAS*	*70 DAS*	*25 DAS*	*70 DAS*		*bu/ac*	*kg /ha*
1. VCS 438* ..	75% † WP–	0.75	Applied to puddled surface 5 ‡ DBS	8.2	21.6	3.5	2.7	1.5	0.2	10.1	131.2	6617
2. Bladex ..	50% WP	1.5	Applied to puddled surface 7 DBS	1.1	13.6	0.2	1.2	4.5	2.7	7.1	136.3	6874
3. Sencor ..	70% WP	0.5	do.	1.9	19.4	0.7	1.2	3.0	1.2	4.4	134.9	6804
4. Sencor ..	70% WP	0.1	do.	5.0	18.5	3.7	1.5	2.5	1.2	9.0	124.8	6294
5. PCP ..	25%G	8.0	Applied to puddled surface 5 DBS	3.7	16.0	3.2	1.7	2.2	0.2	20.1	123.7	6239
6. Unweeded control	—	—	—	22.2	27.5	10.0	10.0	0.0	0.0	88.1	86.6	4368
7. Handweeded control	—	—	Handweeded 21 and 42 D 46	0.0	42.5	0.0	0.0	0.0	0.0	—	141.2	7122

* 10 gm weed seeds applied to each plot 7 days before seeding with rice
† WP= Wettable powder ; G= Granules
‡ DBS= Days before seeding and DAS= Days after seeding
§ Based on scale 0–10, where 0 is good control and 10 is poor control
‖ Based on 0-10 scale, where 0 is no toxicity and 10 is high toxicity
¶ Just before harvest
** Coefficient of variation percent.—7.4 ; LSD (0.05)—13.9 bu/ac and 701 kg/ha

TABLE XI.—Weedicide experiment 8 on broadcast wet-sown rice

*Treatment/ Weedicide**	*Formulation*	*Rate lb. a.i. per acre*	*Method and time of weedicide application*	*Stand counts per sq. ft. 25 DAS*		*Visual weed control rating*		*Visual phyto-toxicity rating at 2.5 DAS ‖*	*Dry weight of weeds per sq. ft. in gm¶*	*Grain Yield***	
				Weeds	*Rice*	*25 DAS*	*70 DAS*			*bu/ac*	*kg/ha*
1. 3,4-DPA followed by MCPA	35%/ 40%EC†	3.0/ 0.75	Sprayed 3, 4-DPA 14 DAS‡ and MCPA 21 DAS	1.1	15.4	3.0	3.5	2.5	42.2	101.1	5099
2. Machete ..	5% G	1.0	Applied to 1 inch 6 DAS	2.1	10.8	4.0	4.0	0.0	42.7	92.0	4640
3. Machete ..	5% G	1.0	Applied to moist soil 6 DAS and field impounded with water 24 hr later	3.0	15.1	3.5	4.5	0.0	63.5	86.1	4342
4. Machete ..	5% G	1.0	Applied to water covering weeds 6 DAS	1.7	13.4	4.5	2.5	0.0	28.0	97.5	4917
5. Linuron ..	50%WP	0.25	Applied to 1 inch water 7 DAS	2.2	12.5	7.5	5.5	0.0	12.0	80.3	4050
6. VCS 438 ..	75%WP	1.0	do.	1.5	8.1	8.0	4.0	2.5	43.7	88.4	4458
7. Sencor ..	70%WP	0.5	Applied to 1 inch water 5 DAS	5.1	12.0	3.5	4.5	0.0	90.2	97.7	4928
8. Sencor/MCPA BGE	70% WP/ 3%G	0.5 0.75	do.	4.6	13.4	4.5	6.0	0.0	43.5	89.9	4534

(*Continued overleaf*)

9. Saturn ..	10%G	1.3	Applied to 1 inch water 6 DAS	4.1	20.4	2.0	1.5	0.0	65.7	93.9	4736
10. NTN 5006/ 2,4-D IPE	7% 1.5% G	1.8/ 0.4	do.	3.6	15.8	0.0	1.5	0.0	63.0	96.4	4352
11. Banvel — D / MCPA	13.3%/ 26.6% EC	0.5/ 0.55	Sprayed to drained field 21 DAS	6.2	10.1	7.5	6.5	0.0	43.5	83.0	4186
12. Banvel — D / MCPA	20.6%/ 20%EC	0.5/ 0.55	Sprayed to drained field 21 DAS	2.4	13.9	7.0	7.0	0.0	74.2	91.6	4620
13. Unweeded control	—	—	—	5.1	15.1	10.0	10.0	0.0	73.5	66.0	3329
14. Handweeded Control	—	—	Handweeded 14 & 42 DAS	0.0	16.1	0.0	0.0	0.0	0.0	105.2	5306

* 10 gm weed seeds added to each plot immediately after seeding
† EC= Emulsifiable concentrate ; G= Granules ; WP= Wettable powder
‡ DAS—Days after seeding
§ Based on 0–10 scale, where 0 is no control and 10 is good control
|| Based on 0–10 scale, where 0 is no phytotoxicity and 10 is high toxicity.
¶ Based on 0–10 scale, where 0 is no phytotoxicity 10 is high toxicity
** Just before harvest
‡‡ Coefficient of variation percent= 4.9 ; LSD (0.05)—9.6 bu/ac and 484 kg/ha

TABLE XII.—Weedicide experiment 9 on broadcast dry-sown rice

Treatment/ Weedicide	Formulation	Rate lb. a.i. per acre	Method and time of weedicide application	Rice stand count per sq. ft. *		Visual weed control rating †		Visual phytotoxicity rating **		Grain yield§	
				Rice	Weeds	28 DAR‡	85 DAR	28 DAR	85 DAR	bu/ac	kg/ha
1. PCP followed by 3, 4.. DPA	20%EC/ 35%EC‖	4.0/3.0	PCP sprayed with the first rains and 3, 4–DPA three weeks later	26.7	2.3	9.0	8.0	1.0	1.0	84.3	4252
2. Machete ..	48%EC	2.0	Sprayed with the first rains after seeding	23.8	1.6	9.3	7.7	1.0	1.0	88.2	4448
3. Machete ..	48%EC	3.0	do.	17.3	1.7	8.7	7.3	3.0	1.0	94.7	4776
4. Machete ..	5%G	2.0	Applied to the surface after seeding & harrowing	23.8	3.2	7.6	7.3	1.0	1.0	97.7	4928
5. Linuron ..	50%WP	0.5	Mixed with fertilizer & applied before seeding	13.5	7.3	4.7	5.0	3.1	1.7	70.8	3571
6. Linuron ..	50%WP	0.5	Applied as 'soil mix' with the first rains after seeding	22.7	16.7	5.3	5.0	2.7	1.3	76.0	3833
7. Saturn ..	10%G	4.0	Applied to the surface after seeding & harrowing	22.3	6.6	8.7	8.0	1.0	1.0	82.9	4181
8. Ordram ..	72%EC	3.0	Mixed with fertilizer & applied before seeding	25.0	13.9	10.0	9.7	1.0	1.0	71.0	3581
9. VCS 438 .	75%WP	1.0	do.	15.3	8.0	7.3	6.7	5.3	3.7	68.3	3445
10. VCS 438 .	75%WP	1.0	Applied as 'soil mix' with the 1st rains after seeding	15.7	17.4	7.6	7.3	6.0	3.3	67.1	3384
11. Unweeded control	—	—	—	29.8	20.7	1.0	1.0	1 0	1.0	80.8	4075
12. Handweeded control	—	—	Handweeded 3 and 6 weeks after first rains	23.7	34.7	10.0	10.0	1.0	1.0	85.0	4287

‖ EC=Emulsifiable concentrate ; G=granules ; WP=Wettable powder
* Three weeks after emergence of rice
‡ DAR—Days after first rains
† Based on 1–10 scale where 1 is no control and 10 is good control
** Based on 1–10 scale where 1 is no toxicity and 10 is high toxicity to rice
§ Coefficient of variation percent.=7.5 ; LSD (0.05) = 10.2 bu/ac and 514 kg/ha

Studies on pasture improvement in the hill country dry zone (patanas) of Ceylon (Sri Lanka)

III. Effects of high nitrogen application on the productivity and feeding value of *Paspalum dilatatum*

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SUMMARY

Paspalum dilatatum pasture in pure sward under the dry patana environment of Ceylon responded to nitrogen fertiliser in a linear fashion up to 336 lb. of nitrogen per acre per year. At this level of application the total dry matter yield was in the region of 10,000 lb. per acre per year and the crude protein percentage was generally over 10 per. cent. when defoliated at 5 weeks interval during the active period of growth. The high rate of nitrogen has to be applied in split doses and that too as far as possible to coincide with the wet spells of the year to enable the pasture to use the highly mobile nitrogen efficiently.

INTRODUCTION

In the dry patana environment of Ceylon, the contribution to pasture production by legume nitrogen is negligible as shown in the earlier paper (Sivasupiramaniam *et al*, 1972). Even in temparate countries liberal applications of inorganic nitrogen up to 300-500 lb. per acre are often made in order to maximise herbage productivity per acre (Holmes 1968). So that in tropical environments for a long time to come nitrogen fertilization would be expected to pay a major

* Based on a thesis presented for the degree of Master of Science (Agriculture) of the University of Ceylon.

role in pasture production. Over 10,000 lb. of dry matter have been obtained in temperate areas with high nitrogen fertilization. Similar or even higher yields can be expected in tropical regions under high nitrogen fertilization (Henzell, 1963 ; Jones et al, 1969).

In Ceylon studies on high nitrogen pasture are limited but recent in origin. Investigations have confirmed the linear relationship between herbage dry matter, production and nitrogen fertilizer, up to levels of over 300 lb. per nitrogen per acre. There was a remarkable increase in the feeding value of the herbage produced (Sivalingam, 1964 ; Fernando, 1969, Appadurai and Arasaratnam, 1969 ; Gunawardena and Appadurai, 1971). Apart from the absence of suitable legumes to grow in admixture with the grasses under the dry patana environment, a further strong justification for the use of high nitrogen levels is the fact that the pasture production is restricted to only six months of the year in these areas due to the alternation of seasonal rains and a prolonged drought season. It is therefore highly desirable to intensify herbage production during the rainy season so as to conserve the maximum amount of herbage and increase the carrying capacity of the selected pastures for this region. It has been observed that nitrogen application promotes the earliness of growth of the pasture (Cowling and Lockyer, 1965) thereby increasing the number of cuts possible during the limited growing season. Further, high nitrogen enhances the off-season growth of the pasture as well (Cowling, 1964). In view of all these desirable features of high nitrogen fertilization an attempt was made to investigate its potential under dry patana conditions of Ceylon.

EXPERIMENTAL

The pasture consisted of a two-year old pure sward of *Paspalum dilatatum* and the design of the exepriment was a latin square with six treatments. The six nitrogen levels consisted of 00, 112, 224, 336, 448, and 560 lb. nitrogen per acre per year and the source of nitrogen was urea. The experiment which was conducted over two years commenced in Maha '69-70 and concluded in Yala/71. Each year the sward was defoliated five times—thrice in Maha and twice in Yala. The size of the plots was 1/50th of an acre. The total nitrogen was applied in five equal portions—one for each crop. But the first two crops in Maha and the first Yala crop received its share of nitrogen fertilizer in two split dressings, one immediately after defoliation and the second two weeks later.

All treatments received 60 lb. of P_2O_5 as ordinary superphosphate and 25 lb. K_2O as muriate of potash at the beginning of the Maha season and another 40 lb. of P_2O_5 and 25 lb. of K_2O at the beginning of the Yala season.

All plots were cut to a height of 2" and sampled for dry matter and crude protein determinations.

RESULTS

The mean dry matter yields for the first and the second year are presented in Tables 1 and 2 respectively while the crude protein percentage data for the first year and the second year Maha is presented in Tables 3 and 4.

Dry Matter Yield

(*a*) *First year.*—Of the total dry matter yield for the year almost 65 per cent was produced in the Maha season while only 35 per cent. was produced in the Yala. The first two cuts in Maha and the first cut in Yala were better than the last cuts in Maha and Yala. The difference was minimal at the no nitrogen level and progressively increased with the increase in the nitrogen level. There was an almost four-fold increase in dry matter production from the no nitrogen level to the 560 lb. nitrogen level. The yield response to each nitrogen increment was significant at 1 per cent level up to 448 lb. nitrogen level.

(*b*) *Second Year.*—The major portion of the dry matter was again produced in the Maha season but the Yala contribution was about 45 per cent. As in the first year the first two Maha cuts and the first Yala cut gave better yields. However, unlike in the first year almost four-fold increase of yield was observed between no nitrogen and 336 lb. nitrogen levels and the yield increase was significant at 1 per cent level up to 336 lb. nitrogen only.

Crude Protein

Generally control plots receiving no nitrogen gave an average value of 10.5 per cent crude protein in the dry matter while the 560 lb. nitrogen treatment gave an average value of over 15 per cent. It is however noteworthy that crude protein averaged only 12.3 per cent. for 448 lb. nitrogen treatments in the first year.

DISCUSSION AND CONCLUSIONS

Total annual production

A comparison of the first and the second year dry matter production shows that the total annual production in the first year was more than in the second year at the lower nitrogen levels viz. 00, 112 and 224 lb. nitrogen while reverse was true at the higher nitrogen levels viz. 336, 448 and 560 lb. nitrogen. This may be due to the residual effect from the pre-experimental period in the first year and/or increase in the fertility status of the soil at high levels of nitrogen. This explanation appears to receive some support from the data on the nitrogen recovered in the harvested dry matter which is graphically represented in figure 1. The data indicates that in general recovery of nitrogen was very high in the low nitrogen treatments in the first year Maha—at 112 lb. nitrogen level the recovery was over 100 per cent while in the second year Maha the percentage recovered was much less. On the other hand at the high nitrogen levels the reverse was true.

Yields of individual cuts

In both years the pattern of production was the same, the first cut in Yala giving the highest yeild. The third crop in Maha and the second crop in Yala were generally poor, particularly at high nitrogen levels, due presumably to the limited availability of water.

Yields responses to nitrogen

The yield response to nitrogen in terms of dry matter shows different trends in the two years. In the first year the excess production for each additional lb. of applied nitrogen increased at a decreasing rate right from the zero level of nitrogen application.

This was possibly due to the residual effect from the previous year discussed earlier. In the second year however there was an increasing degree of response initially (up to 336 lb. nitrogen) but thereafter there was a gradual decrease in response viz. showing a linear response up to 336 lb. of nitrogen applied. The factors are represented graphically in figure 2.

Figure 1

Diagrammatic representation of percentage of nitrogen recovered

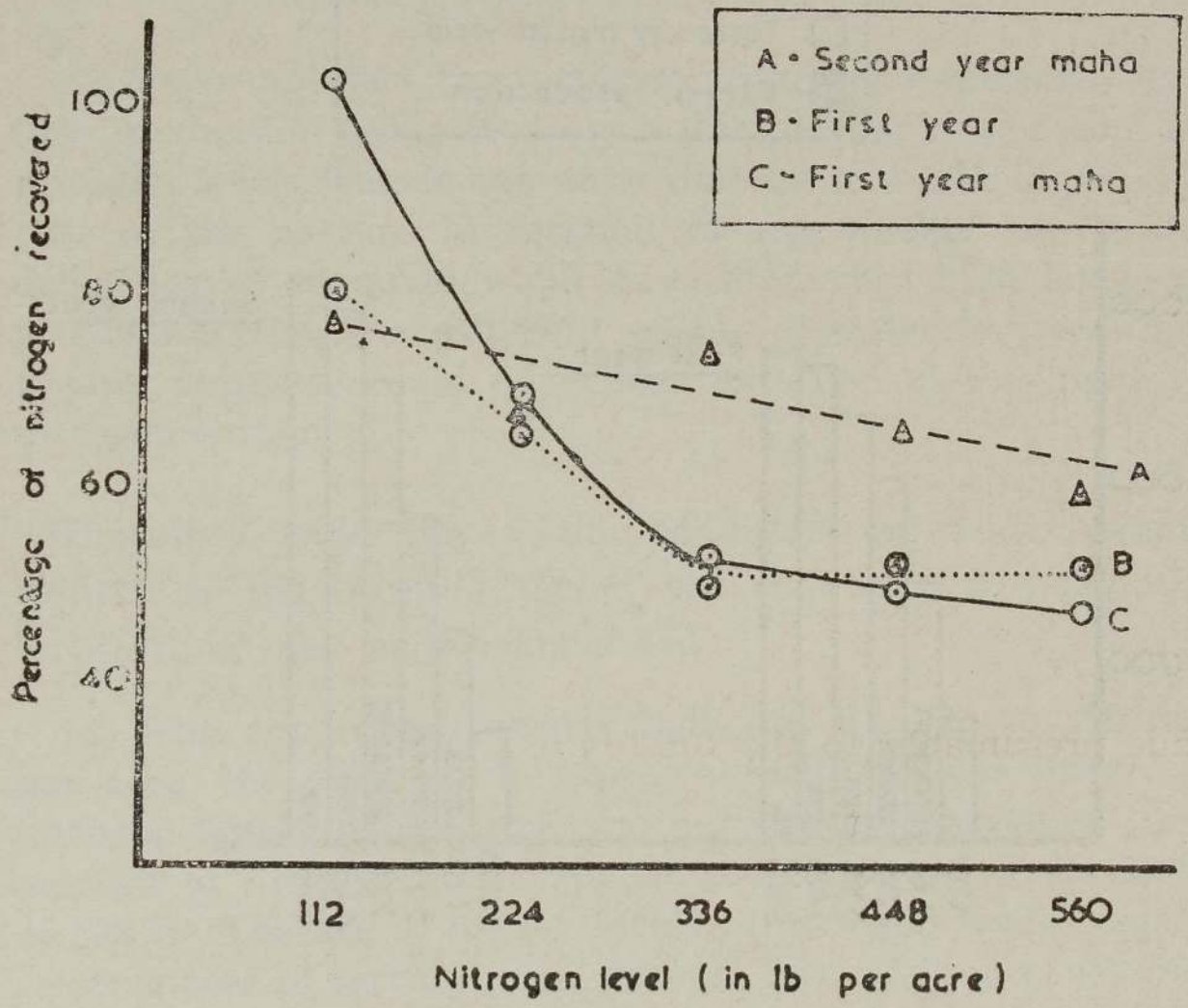
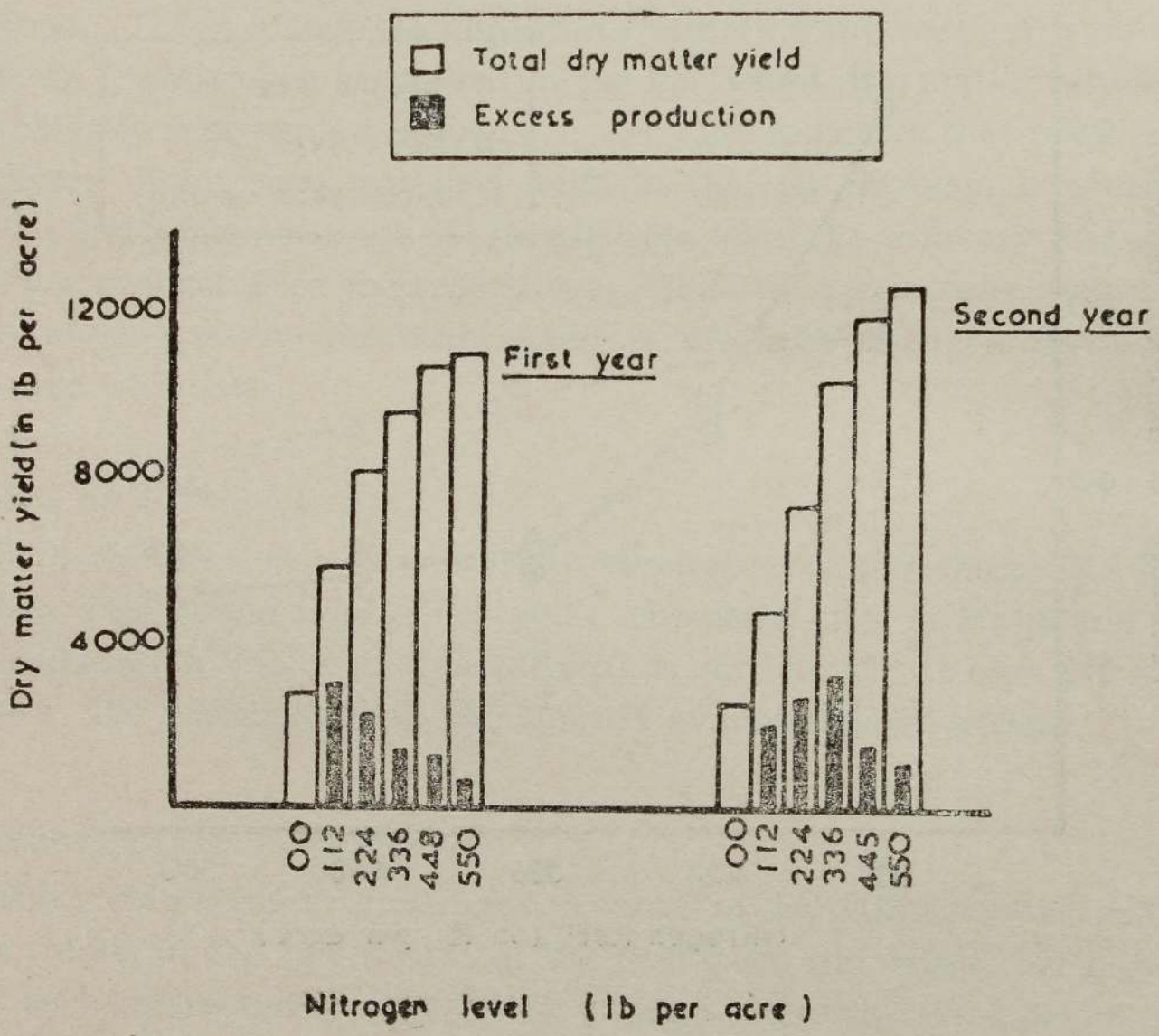


Figure 2

Diagrammatic representation of total dry matter yield and excess production



Nitrogen utilization efficiency

Regression analysis data indicated that nitrogen utilization efficiency viz. the return in terms of herbage dry matter per lb. of nitrogen applied was 21.7 lb. for the first year and 25.1 for the second year, indicating that in the second year there was a better response.

Even though the crude protein content of the control plots receiving no introgen was fairly satisfactory, it is apparently due to the fact that the growth was restricted, and the harvested herbage mostly comprised leaves, which contain a high percentage of crude protein (Waite and Sastry, 1949) compared to the leaf sheath or the stem.

An important fact that emerges from this experiment is that pasture production tends to show a diminishing response to the higher nitrogen levels. This is apprently due not to a lack of potential on the part of the pasture to respond to any further nitrogen but to a deficiency of adequate water to sustain very high levels of pasture production. Given a sufficient supply of water for pasture growth a greater response could have been expected at the highest levels of nitrogen employed.

Therefore, under the existing conditions on the dry patanas, where rainfall is the limitnig factor, the following strategy of nitrogen fertilization may be recommended :

(*a*) The experiment clearly indicates that up to 336 lb. nitrogen per acre, the response to nitrogen fertilizer was linear ; at higher nitrogen levels the response was curvilinear. Therefore, the optimum amount of nitrogen to be applied would appear to be in the region of 336 lb. The use of higher levels of nitrogen would depend on the relative cost of fertilizer and income from animal production.

(*b*) Since 60 per cent of the total herbage is produced in Maha and only 40 per cent in Yala, the total amount of nitrogen to be applied too should be applied accordingly.

(*c*) Split applications of the nitrogen fertilizer are necessary on account of the distribution of the rainfail. The practice adopted in this experiment appears to be quite satisfactory.

(*d*) Since the third harvest in Maha and the second harvest in Yala produced much less dry matter than the other harvests the amount of nitrogen applied too should be divided proportionally.

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TABLE 1.—Mean Dry Matter Yield in lb. per Acre (First Year)

Treatment	*Maha*				*Yala*			
(*lb. N per acre*)	*1st cut*	*2nd cut*	*3rd cut*	*Total*	*1st cut*	*2nd cut*	*Total*	*Total for the whole year*
00	783	602	422	1807	498	433	931	2738
112	1405	1218	1055	3678	1065	885	1950	5628
224	1667	1607	1462	4736	1777	1303	3080	7816
336	1877	1852	1630	5359	2240	1535	3775	9134
448	2047	2052	1845	5944	2623	1620	4243	10187
560	2110	2135	1823	6064	2866	1653	4519	10587

C.V.= 6.26%

L.S.D. at 1% between N means (Total)= 794 lb./acre.

TABLE 2.—Mean Dry Matter Yield in lb. per Acre (Second Year)

Treatment	*Maha*				*Yala*			
(*lb. N per acre*)	*1st cut*	*2nd cut*	*3rd cut*	*Total*	*1st cut*	*2nd cut*	*Total*	*Total for the whole year*
00	560	503	391	1454	609	490	1009	2463
112	829	871	661	2361	1095	1040	2135	4496
224	1282	1426	975	3683	1676	1575	3251	6934
336	2140	2130	1218	5488	2345	2096	4441	9929
448	2332	2408	1343	6083	3026	2186	5212	11295
560	2690	2425	1286	6401	3075	2510	5585	11986

C.V.= 8.25%

L.S.D. at 1% between N means (Total)= 1070 lb./acre.

TABLE 3.—Mean Crude Protein Percentage

Treatment		*First Year*		*Secind Year Maha*
00	...	10.50	..	12.46
112	...	10.69	..	13.64
224	...	11.56	..	14.90
336	...	11.45	...	16.97
448	...	12.81	..	17.23
560	...	15.62	..	17.97

Fertilizer experiments with chilli *(Capsicum annum)* at Gannoruwa

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INTRODUCTION

Chillie (or red papper) *Capsicum annum,* is an important condiment in Ceylon. It is a major element in curries and enters into most other dishes. It is also used in chutnies, pickels and in Ayurvedic medicine. The fruits contain vitamins A, B and C in addition to the active principle capsaicin.

Dried chilli is such an indispensable condiment in the food of the people of Sri Lanka that in 1966 Rs. 43 million were spent in the importation of this commodity (3). This value, however, has been steadily declining and the average annual value spent on the import of dried chilli from 1969 to 1971 is Rs. 27 million (4).

One of the main interests of the Division of Agricultural Chemistry of the Central Agricultural Research Institute, Peradeniya, between February and July 1971 was the investigation of the basic responses of chilli to nitrogen, phosphorus and poassium fertilizers at Gannoruwa. Such responses have been fairly well established for the dry zone (1, 2, 5) but relatively little effort has been directed to the study of fertilizer responses to chilli in the wet zone of the country. These studies were stimulated by a policy directive to increase chilli production in the country. Whereas most of the dried chilli, (red pepper) was produced in the dry zone, it was hoped that green (undried) chilli would be produced in the wet zone.

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MATERIALS AND METHODS

This paper presents results and discussions of two investigations on fertilization of chilli carried out at Gannoruwa (Peradeniya) from February to July 1971.

Experiment 1

The first experiment was a NPK, 3 × 3 × 3 factorial intended to test the effect of the three major fertilizer nutrients on the yield of green chilli. The 27 experimental sub-plots, each with an area of 15 × 10 feet, were replicated three times in randomized blocks. The levels of nitrogen, phosphorus and potassium used were—

Nitrogen : 0,40 and 80 lb. N. per acre supplied as ammonium sulphate.

Phosphorus : 0,50 and 100 lb. P_2O_5 per acre supplied as concentrated superphosphate.

Potassium : 0,30 and 60 lb. K_2O per acre supplied as muriate of potash.

The nitrogen fertilizer, ammonium sulphate, was split applied as a preplant application together with four top dressings in the following proportions.

Preplant	.. ..	2/9 of total
Two weeks after planting	..	2/9 of total
Five weeks after planting	..	1/9 of total
Eight weeks after planting	..	2/9 of total
Twelve weeks after planting	..	2/9 of total

Phosphorus and potassium were all applied before planting.

Thirty-day old seedlings of the Maha Illuppallama selection of *Capsicum annum*, variety longum, were transplanted at the rate of three seedlings per hole in rows of spacing of 1 foot in the row and 3 feet between rows. Vacancies were filled within the first two weeks. Fertilizers were applied per hole in a ring round each plant, approximately 4-5 inches from base of the stem, and lightly worked into the soil. Plants were irrigated immediately afterwards. Azoedrin at the rate of 1 fluid oz. in 4 gallons water and Thiovit at approximately 1 oz. were sprayed four weeks from planting.

The soil at the location of the experiment had the following characteristics :—

Texture	.. ...	Sandy clay
pH (Soil : H_2O-1 : 1)	..	5.5
Organic matter	.. ..	1.70 per cent

Nitrogen (Total)	..	0.16 per cent
Available phosphorus (Oslen's)	..	25.2 lb. P_2O_5 per acre
Exchangeable potassium	..	0.22 m.e. per 100 gm soil

Green chillies were first picked 80 days after transplanting when plants were 110 days old.

Experiment 2

In the second experiment two levels of fertilizers were tested out each at five methods of fertilizer application, giving a total of ten treatments. The treatments were replicated three times.

The levels of nutrients were :—

(1) 40 lb. N ; 50 lb. P_2O_5 and 30 lb. K_2O per acre ; and

(2) 80 lb. N ; 100 lb. P_2O_5 and 60 lb. K_2O per acre

Nitrogen, phosphorus and potassium were applied as ammonium sulphate, concentrated superphosphate and muriate of potash respectively.

At each level the nutrients were applied in relation to crop growth as follows :—

(1) N, P_2O_5 and K_2O all applied at planting.

(2) P_2O_5 and K_2O all applied at planting ; N split applied at planting and 2, 5, 8 and 12 weeks after planting in the ratio of 2/9, 2/9, 1/9, 2/9 and 2/9 respectively.

(3) K_2O all applied at planting ; N split-applied at the same times and in the same ratios as in treatment (2) and P_2O_5 split-applied in the ratio of 2/3 and 1/3 at planting and five weeks after planting respectively.

(4) N split-applied at the same times and in the same ratios as in treatment (2) ; P_2O_5 all applied at planting and K_2O split-applied in the ratio of 2/3 and 1/3 at planting and 5 weeks after planting respectively.

(5) N, P_2O_5 and K_2 split-applied at the same times and in the same ratios as in treatment (2) for nitrogen.

The scheme for application of N, P_2 O_5 and K_2 O in the treatments is shown in Annex I. The important characteristics of the soil at the location of the experiment were as follows :

Texture	..	Sandy clay
PH (Soil : H_2O-1 : 1)	..	5.3
Organic matter	..	1.68 per cent
Nitrogen (Total)	..	0.16 per cent
Available phosphorus (Oslen's)	..	44.4 lb. P_2O_5 per acre
Exchangeable potassium	..	0.11 m.e. per 100 gm. soil

Picking of green chillies commenced 80 days after transplanting when plants were 110 days old. There were a total of six pickings.

Fertilizers that were applied before planting were well mixed with soil at each planting hole. Those applied after planting were placed in a ring round each plant approximately 4-5 inches from the base of the plants and lightly worked into the soil. Plants were irrigated immediately after each fertilizer application.

RESULTS AND DISCUSSION

In these experiments chillies were harvested green because the production of dry chillies is confined mostly to the dry zone.

Experiment 1

Data on the yield of green chilli from the N.P.K. factorial experiment are presented in Table 1. The effect of fertilizer was due only to nitrogen. There was a highly significant response (P = 0.01) to nitrogen fertilizer at the rate of 40 lb. N per acre. The increase in mean yield of green chilli due to the first level of nitrogen was 11.5 cwt. per acre, but there was no further increase due to further addition of this element.

TABLE 1.—Mean yields of green chilli due to nitrogen, phosphorus and potassium fertilization (cwt/acre)

Levels		*N*	P_2O_5	K_2O
1	..	13.7	19.3	23.2
2	..	25.2	22.6	19.9
3	..	25.2	22.0	20.9
L.S.D. (0.01)	..	6.8	—	—
L.S.D. (0.05)	..	5.1	—	—
C.V. —	..	43.4%	—	—

These results are similar to those of fertilizer experiments that have been conducted earlier in the dry zone by other investigators. Joachim and Paul (5) have reported appreciable yield increases from nitrogen fertilizers at Anuradhapura and Vavuniya with Tuticorin chilli, but found no significant effect due to either phosphorus or potassium fertilizers. Similar results have been reported from a fertilizer experiment conducted at Mathakala during *yala* 1956 where responses were obtained only to nitrogen fertilizers, at the rate of 30 lb. N per acre (1). Nitrogen at the rate of 60 lb. element per acre gave no further significant increase in yield. Responses to 40 lb. N per acre have been reported from Tinnevely during the *maha* season of 1960 with the variety Myliddy (2). There was also a distinct response to nitrogen even at the 80 lb. N per acre level although yields at this level were not significantly superior to those at the 40 lb. N per acre level.

The effect of phosphorus fertilization on yield of green chilli was not significant although there was a slight increase of approximately 3 cwt. per acre, from zero to 50 lb. P_2O_5 per acre treatment. At the higher level of fertilization (100 lb. P_2O_5 × per acre) there was no increase in yield. In fact there was a slight depression in yield of green chilli. It may be mentioned that optimum level of phosphorus at Tinnevely was found to be 32 lb. P_2O_5 per acre (2).

As seen in Table 1 potassium fertilization had no effect on yield of green chilli. In fact, there was a slight depression in yield even when this nutrient was added at the rate of 30 lb. K_2O per acre. Results of experiments reported from the dry zone indicate no response to potassium by chilli (1, 2, 3).

The high co-efficient of variation in the experiment may be attributed mainly to the heterogenous nature of the soil in this experiment which was spread out over a relatively extensive area of land.

Experiment 2

The total yield of green chilli as affected by fertilizer treatments is shown in Table 2. The figures are the yields of six pickings up to the end of the experiment. Simple analysis of variance showed no significant effect due to treatments. Mean yields between levels of fertilizer were significant at the 5 per cent level of probability. At the higher level of fertilization there was an yield increase of approximately 10 cwt. per acre over the lower level. Mean yield within method of fertilizer application was not significant. On the other hand application of all the fertilizers at planting (Treatment Nos. 1 and 6) were

significantly inferior to treatments where only phosphorus and potassium were applied at planting and nitrogen was applied in five split doses (Treatment Nos. 2 and 7).

TABLE 2.—Yield of green chilli as affected by levels and times of fertilizer application (cwt./acre)

Treatment Nos.	$N : P_2O_5 : K_2O$ 40 : 50 : 30	$N : P_2O_5 P_2 : K_2O$ 80 : 100 : 60	*Mean*
1 and 6 ..	31.3 ..	41.9 ..	36.7
2 and 7 ..	46.9 ..	60·0 ..	53.5
3 and 8 ..	46.7 ..	52.1 ..	49.4
4 and 9 ..	38.1 ..	60.6 ..	49.4
5 and 10 ..	42.0 ..	42.7 ..	42.4
Mean ..	41.0 ..	51.4 ..	—

Treatments : Not significant.

Mean yield between levels of fertilizer : Significant, L.S.D. (0.05) = 8.3 cwt. acre.

Mean yield within method of fertilizer application : Not significant.

All basal versus split application of fertilizer : Significant, L.S.D. (0.05 = 13.1 cwt. acre. Co-efficient of variation ..... 23.4%.

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ANNEX I—.Fertilizer treatments showing rates and times of application of nitrogen, phosphorus and potassium (lb. per acre)

Treatment No.	*Total amount of nutrients lb/ac*			*Preplant application lb/ac*			*TOP DRESSING*											
							1. *Two weeks after planting*			2. *Five weeks after planting*			3. *Eight weeks after planting*			4. *Twelve weeks after planting*		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
1	40	50	30	40	50	30	—	—	—	—	—	—	—	—	—	—	—	—
2	40	50	30	8.88	50	30	8.88	—	—	4.44	—	—	8.88	—	—	8.88	—	—
3	40	50	30	8.88	33.33	30	8.88	—	—	4.44	16.66	—	8.88	—	—	8.88	—	—
4	40	50	30	8.88	50	20	8.88	—	—	4.44	—	10	8.88	—	—	8.88	—	—
5	40	50	30	8.88	11.11	6.66	8.88	11.11	6.66	4.44	5.55	3.33	8.88	11.11	6.66	8.88	11.11	6.66
6	80	100	60	80	100	60	—	—	—	—	—	—	—	—	—	—	—	—
7	80	100	60	17.77	100	60	17.77	—	—	8.88	—	—	17.77	—	—	17.77	—	—
8	80	100	60	17.77	66.66	60	17.77	—	—	8.88	33.33	—	17.77	—	—	17.77	—	—
9	80	100	40	17.77	100	60	17.77	—	—	8.88	—	20	17.77	—	—	17.77	—	—
10	80	100	60	17.77	22.22	13.33	17.77	22.22	13.33	8.88	11.11	6.66	17.77	22.22	13.33	17.77	22.22	13.33

METEOROLOGICAL REPORT

SUMMARY—APRIL TO SEPTEMBER, 1973

APRIL.—Intermonsoon weather continued until 25 April. There was a mild southwesterly pressure gradient from the 26th. Rainfall was fairly heavy and widespread on the 3rd (6 stations recording over 125 mm.) There were light isolated showers on the 12th, 13th, 26th and 27th and practically no rain from 28th to 30th.

The larger monthly totals of rainfall (totals over 500 mm. were experienced over a few isolated areas in the Ratnapura District. In most parts of Western and Sabaragamuwa Provinces and parts of Galle, Puttalam, Kurunegala and Badulla Districts rainfall ranged from 200 to 500 mm. Rainfall over the rest of the Island was below 200 mm. The highest monthly totals were 063 mm. at Pussella Division (Kuruwita), 568 mm. at Pelmadulla and 552 mm. at Keragala Estate (Kuruwita).

Rainfall was above normal over most parts of Western Province and Puttalam District and parts of Southern Province and Ratnapura District. Elsewhere rainfall was mainly below normal. The highest excesses were 246 mm. at Hunumulla, 220 mm. at Westerseaton Farm (Negombo) and 188 mm. at Dompe. The biggest deficits were 300 mm. at Weweltalawa Division, Halgolla State Plantation (Yatiyantota) 232 mm. at Geelong Estate (Monaragala) and 229 at Pandupola.

There were 10 daily falls over 125 mm. the highest being 166 mm. at Siyambalawewa Estate (Bingiriya) on the 3rd. Twelve stations, mainly in the Jaffna and Trincomallee Districts, reported nil rainfall.

Temperatures were above normal from 1st to 25th and appreciably above normal from 26th to 30th. The highest temperature recorded was 37.8° C at Trincomalee on the 30th. The lowest at a coastal station was 22.3 C at Katunayake on the 20th and for the whole Island 8.4°C at Nuwara Eliya on the 13th. Day humidity ranged from 65 to 75%. Night humidity ranged from 80 to 90% in the coastal areas and 90 to 95% elsewhere. Mean cloud amounts were above normal while mean air pressures were below normal. Wind mileages were about normal and the direction southeasterly in the North and Northeast and variable elsewhere.

MAY.—Thunder activity prevailed over the Island during most of the month. There was a temporary advance of the southwest monsoon on the 11th and again on the 20th but the usual moderate to heavy intermittent rain which characterises the onset of the monsoon was absent. Light to moderate rain was experienced from the 1st to the 15th. From 16th to the 18th rainfall was light and isolated. Rainfall was moderate and fairly widespread from the 19th to the 22nd and again from 24th to the 26th. From the 27th to the end of the month there were light scattered showers in he southwest quarter, the southwesterly wind stream becoming shallow.

The larger monthly totals of rainfall (totals over 400 mm.) were experienced over parts of Colombo, Kegalla, Kalutara, Ratnapura and Galle Districts. In other parts of the southwest quarter of the Island (excluding parts of Central Province) and parts of Trincomalee, Puttalam and Badulla Districts rainfall ranged from 100 to 400 mm. Rainfall over the rest of the Island was below 100 mm. The highest monthly totals were 760 mm at Pelawatte State Plantation (Meegahatenne), 668 mm. at Weweltalawa Division, Halgolla State Plantation, (Yatiyantota) and 658 mm. at Tawalama (Hiniduma).

Rainfall was above normal over parts of Northern Province and parts of Trincomalee and Puttalam Districts and isolated areas in the Colombo, Galle and Batticaloa Districts. Elsewhere rainfall was below normal. The highest excessess were 179 mm. at Organge Hill Estate (Ragama), 75 mm. at Baddegama Estate (Baddegama) and 61 mm. at Labuduwa (Galle). The highest deficits were 515 mm. at Norton Bridge, 456 mm. at Luccombe Estate, Maskeliya and 418 mm. at Hapugastenne State Plantation (Ratnapura).

There were eleven daily falls over 125 mm. the highest being 160 mm. at Panadura on the 6th. Four stations reported nil rainfall.

Temperature were appreciably above normal from the 1st to the 4th and above normal rest of the month. The highest temperature recorded was 38.0°C at Anuradhapura on the 2nd. The lowest at a coastal station was 21.7°C at Katunayake on the 3rd and for the whole island 10.7°C at Nuwara Eliya on the 1st. Day humidity ranged from 60 to 70% in the Eastern and North Central Provinces and 70 to 80 per cent. elsewhere. Night humidity ranged from 80 to 90%. Mean cloud amounts were above normal, while mean air pressures were below normal and below normal elsewhere and the direction mainly southwesterly.

JUNE: The month commenced with rather weak monsoon conditions and a mild southwesterly pressure gradient. The monsoon stream strengthened on the 4th, due to a depression in South East Arabian Sea and showers were fairly widespread on the 4th, 5th and 6th. A few light showers were experienced from 7th to the 10th. Rain was mainly confined to the south-west quarter from the 10th to the 20th and again from 27th to the end of the month. From the 21st to the 26th rainfall spread to parts of North and East also.

The larger monthly totals of rainfall (totals over 400 mm.) were experienced over most parts of Kalutara, Galle, Matara, Ratnapura, Kandy and Kegalla Districts. Elsewhere in the south-west quarter rainfall ranged from 200 to 400 mm. Rainfall over the rest of the Island was below 200 mm. The highest monthly totals were 891 mm. at Weweltalawa (Halgolla State Plantation, Yatiyantota), 823 mm. at Carolina Group (Watawala) and 798 mm. at Arslena Estate Ginigathena).

Rainfall was below normal in the Central and North-Central Provinces and parts of Badulla, Ratnapura, Kurunegala, Kegalla, Negombo, Batticaloa and Jaffna Districts. Elsewhere rainfall was above normal. The highest excesses were 347 mm. at Labuduwa, 315 mm. at Beausejour Estate (Nakiyadeniya) and 265 mm. at Hiyara Reservoir. The biggest deficits were 261 mm. at Doragalla Group. (Pussellawa), 257 mm. at Maskeliya Hospital and 250 mm. at Hellbodde North Estate (Katukitula).

There were four daily falls over 125 mm. the highest being 148 mm. at Norton Bridge on the 22nd. Thirteen stations reported nil rainfall.

Temperatures were above normal. The highest temperature recorded was 37.3°C at Vavuniya on the 21st. The lowest at a coastal station was 21.8°C at Galle on the 28th and for the whole Island 12.1°C at Nuwara Eliya on the 27th. Day humidity ranged from 60 to 70% on the eastern half of the Island and 70 to 85% elsewhere. Night humidity ranged from 80 to 95%. Mean cloud amounts were above normal, while mean air pressures were below normal. Wind mileages were below normal and the direction mainly southwesterly.

JULY: The westerly wind stream (upto 5,000 metres) strengthened during the first three weeks due to depressional activity in North Bay of Bengal. Light to moderate rain was fairly widespread from the 1st to the 6th. From the 7th to the 20th showers were light and confined

mainly to the south-west quarter. From the 21st to the end of the month winds above 1,500 metres weakwened and showers were fairly widespread with thunder activity developing inland during the afternoon.

The larger monthly totals (totals over 300 mm.) were experienced over most parts of Kalutara, Kegalla, Ratnapura, Galle and Kandy Districts. Elsewhere in the south-west quarter and in parts of Anuradhapura, Vavuniya and Badulla Districts rainfall ranged from 100-300 mm. Rainfall over the rest of the island was below 100 mm. The highest monthly totals were 713 mm. at Weweltalawa (Halgolla tenne) and 672 mm. at Kellie Estate (Dolosbage).

Rainfall was below normal in the Kandy, Ratnapura, Hambantota, Colombo and Nuwara Eliya Districts and parts of Northern, Eastern, North-Western and Uva Provinces. Elsewhere rainfall was above normal. The highest excesses were 328 mm. at Sirikandura Estate (Matugama), 307 mm. at Gikiyanakanda Estate (Neboda) and 282 mm. at St. Leoupard Estate (Elpitiya). The biggest deficits were 288 mm. at Luccombe Estate (Maskeliya), 205 mm. at Blackwater Estate (Ginigatheena) and 195 mm. at Carolina Group (Watawala).

There were sixteen falls of over 125 mm. the highest being 169 mm. at Dunedin (Dehiowita) on the 30th. Thirteen stations reported nil rainfall.

Temperatures were above normal. Nuwara Eliya day temperatures were well above normal, from the 20th to the 28th. The highest temperature recorded was 37.8°C at Anuradhapura on the 22nd. The lowest at a coastal station was 21.0°C at Galle on the 5th and for the whole Island 10.9°C at Nuwara Eliya on the 29th. Day humidity ranged from 60 to 70% on the eastern half of the island and 70 to 80% elsewhere. Night humidity ranged from 75 to 80% in the East and 80 to 90% elsewhere. Mean cloud amounts were above normal, while mean air pressures were below normal. Wind mileages were below normal and the direction mainly southwesterly.

AUGUST : Normal monsoon conditions prevailed during the first eight days with scattered light to moderate showers in the south-west and over the hills. From the 9th to the 11th fairly widespread rain was experienced over the Island due to a trough of low pressure in the Bay of Bengal. Rainfall eased off gradually from the 12th and from the 17th to the 21st there were only very light isolated showers in the south-

west quarter. The monsoon strengthened thereafter and there were ligh to moderate showers particularly over the hill country. Five falls over 125 mm. were recorded on the 26th.

The larger monthly totals (totals over 300 mm.) were experienced over parts of Kandy, Nuwara Eliya and Ratnapura Districts. Elsewhere over most parts of the south-west quarter rainfall ranged from 100-300 mm. Over the rest of the Island rainfall was mainly below 100 mm. The highest monthly totals were 830 mm at Weweltalawa (Halgolla Estate, Yatiyantota), 772 mm. at Carolina Group (Watawala), 754 mm. at Theydon Bois (Nawalapitiya).

Rainfall was above normal over parts of Kandy, Nuwara Eliya and Jaffna Districts and a few isolated areas in Mannar, Anuradhapura, Badulla and Batticaloa Districts. Elsewhere rainfall was below normal. The highest excesses were 252 mm. at Weweltalawa, 251 mm. at Blair Athel Essate (Dickoya) and 215 mm. at Labookelle Estate (Labookele). The biggest deficits were 190 mm. at Sirikandura Estate (Matugama). 167 mm. at Gikiyanakanda Estate (Neboda), and 156 mm. at Baddegama Estate (Baddegama).

There were six falls of over 125 mm. the highest being 161 mm. at Gilimale Estate (Gilimale) on the 26th. Eight stations reported nil rainfall.

Day temperatures were below normal and night temperatures were a little above normal. The highest temperature recorded was 35.9°C at Batticaloa on the 28th. The lowest at a coastal station was 22.1°C at Jaffna on the 11th and for the whole Island 11.8°C at Nuwara Eliya on the 3rd. Day humidities ranged from 60-65 per cent in the Estate and 65-75 per cent elsewhere. Night humidities ranged from 75-90 per cent. Cloud amounts were above normal, while mean air pressures were below normal. Wind mileages were below normal and the direction mainly southwesterly.

SEPTEMBER : There was a spell of dry weather during the first six days. Evening thunderstones developed over the hills from the 7th and there were isolated showers till the 12th. From the 13th to the 15th showers were rather widespread. Scattered showers were experienced in the south-west from the 16th to the 21st. There was isolaed thunder activity from the 25th becomming more widespread from he 27th till the end of the month.

The larger monthly totals (totals over 300 mm.) were confined to a small area in Kegalla and Kandy Districts. Elsewhere over the most parts of the south-west quarter and parts of Vavuniya, Trincomalee, Anuradhapura, Matale, and Badulla Districts rainfall ranged from 100 to 300 mm. Over the rest of the Island rainfall was mainly below 100 mm. The highest monthly totals were 318 mm. at Yatiyantota (Weweltalawa Division, Halgolla Group), 309 mm. at Nawalapitiya. (They don Bois Group) and 291 mm. at Gammaduwa (Dooroomadella Estate).

Rainfall was above normal in parts of the Nothern and North-Central Provinces and parts of Matale, Kandy, Badulla, Batticaloa, Ratnapura, Galle and Matara Districts. Elsewhere rainfall was below normal. The highest excesses were 168 mm. at Kanukkoni, 155 mm. at Gommaduwa (Dooroomadella Estate) and 143 mm. at Topawewa. The biggest deficits were 421 mm. at Ginigathena (Kenilworth Estate), 367 mm. at Watawela (Carolina Group) and 337 mm. at Dolosbage (Kellie Estate).

There was only one fall of over 125 mm. in a day namely 146 mm. at Yatiyantota on the 30th. Six stations (all in the North-Western Province) reported nil rainfall.

Temperatures were mostly above normal. The highest temperature recorded was 36.2°C at Vavuniya on the 1st, and again at Trincomalee on the 5th. The lowest at a coastal station was 22.1°C at Batticalo on the 13th and for the whole Island 9.2°C at Nuwara Eliya on the 1st. Day humidity ranged from 60 to 75% and night humidity from 80 to 90%. Cloud amounts were below normal, while mean air pressures were a little below normal. Wind mileages were mostly below normal and the direction mainly southwesterly.

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METEOROLOGICAL REPORT

APRIL 1973

Station	Temperature				Humidity		Cloud Amount	Rainfall			
	Mean Maximum	Offset	Mean Minimum	Offset	Day %	Night %		Amount	Offset	Rain days	Offset
Anuradhapura	34.9	+1.6	25.0	+1.4	66	93	5.0	69.1	—117.8	12	1
Badulla	30.1	+1.0	19.8	+0.7	68	90	5.5	103.6	—93.0	10	—7
Batticaloa	31.9	+0.8	26.0	+1.1	75	89	5.0	29.5	—42.9	8	+1
Colombo	32.3	+1.2	25.5	+1.2	76	89	5.8	253.8	—6.0	18	0
Diyatalawa	26.2	+0.5	16.3	+0.4	74	94	5.0	96.0	—114.1	16	—2
Galle	31.0	+0.9	25.4	+0.6	72	82	5.5	109.7	—142.8	19	—
Hambantota	31.7	+0.8	25.8	+1.1	75	86	5.8	113.0	—4.0	7	+3
Jaffna	33.4	+1,3	28.1	+1.3	70	81	5.8	15.2	—54.9	5	—2
Kandy	31.1	+0.2	22.0	+0.9	68	88	6.0	132.6	—55.6	15	+3
Kankesanturai	34.5	—	26.7	—	70	91	5.0	5.1	—49.0	2	—2
Katunayake	33.2	—	24.8	—	66	82	5,6	323.1	—	14	—
Kurunegala	33.9	+1.1	24.8	+1.1	71	93	6.0	204.7	—58.4	13	—3
Maha Illuppallama	34.2	—	24.4	—	64	86	5.6	95.8	—	9	—
Mannar	33.1	+0.8	26.6	+1.0	74	87	5.8	149.6	+61.2	7	—1
Nuwara Eliya	24.3	+2.4	12.0	+2.0	75	91	5.6	79.5	—74.2	11	—5
Puttalam	33.3	+1.4	25.5	+1.0	72	89	5.3	128.8	—8.9	11	+1
Ratmalana	32.3	—	24.9	—	68	86	6.1	220.7	—	23	—
Ratnapura	34.4	+1.5	23.8	+0.6	74	95	6.0	343.7	+3.1	21	0
Trincomalee	33.4	+1.4	26.7	+1.3	67	82	5.2	9.9	—66.8	3	—4
Vavuniya	35.3	—	24.7	—	61	88	6.4	83.8	—59.5	12	+1

MAY 1973

Station	Temperature				Humidity		Cloud Amount	Rainfall			
	Mean Maximum	Offset	Mean Minimum	Offset	Day %	Night %		Amount mum	Offset	Rain Days	Offset
Anuradhapura	33.6	+0.9	25.2	+0.6	68	91	5.6	45.2	—54.4	5	—3
Badulla	31.2	+1.4	20.3	+1.1	64	90	6.1	83.3	—31.0	8	—3
Batticaloa	33.2	+0.8	26.3	+0.8	70	82	5.7	12.7	—18.5	3	—2
Colombo	31.2	+0.6	25.9	+0.6	80	89	6.8	317.2	—35.4	21	—2
Diyatalawa	26.8	+0.9	17.8	+0.9	72	87	5.1	66.3	—76.7	8	—6
Galle	29.8	+0.4	25.8	+0.2	76	80	6.2	263.6	—38.7	25	+4
Hambantota	30.6	0	25.9	+0.5	79	84	6.2	129.8	+8.9	14	+2
Jaffna	31.6	+0.3	28.2	+0.5	77	83	6.2	73.4	+10.7	3	—1
Kandy	30.2	+0.4	22.0	+0.6	68	85	6.8	61.2	—128.8	14	+3
Kankesanturai	33.8	—	27.7	—	72	85	5.4	46.5	—0.7	1	—3
Katunayake	31.5	—	25.3	—	71	82	6.4	292.4	—	21	—
Kurunegala	32.0	—0.3	25.3	+0.8	75	89	6.2	88.1	+108.5	19	+3
Maha Illuppallama	33.4	—	25.1	—	65	82	5.4	36.3	—	6	—
Mannar	31.9	0	27.4	+0.3	77	83	6.1	58.9	+9.6	3	—
Nuwara Eliya	22.6	+1.3	13.8	+1.7	78	88	6.2	136.9	—99.8	14	—3
Puttalam	32.4	+1.0	26.4	+0.4	74	87	6.2	76.7	—22.1	7	—3
Ratmalana	30.9	—	25.4	—	72	82	6.8	372.6	—	22	—
Ratnapura	32.5	+0.8	24.2	+0.4	79	93	7.0	280.9	—213.4	26	+2
Trincomalee	35.1	+1.5	27.2	+1.1	62	74	5.8	110.7	+42.9	7	+1
Vavuniya	34.4	—	25.3	—	62	86	6.2	48.3	—62.7	8	+1

JUNE 1973

Station	Temperature				Humidity		Cloud Amount	Rainfall			
	Mean Maximum	Departure	Mean Minimum	Departure	Day %	Night %		Amount mm	Departure	Rain Days	Departure
Anuradhapura	33.1	+0.9	25.3	+0.6	66	89	5.4	6.4	—7.1	5	+1
Badulla	30.6	+0.8	19.4	+0.8	62	90	6.2	22.9	—1.2	5	—1
Batticaloa	33.8	+0.3	25.8	+0.4	65	80	5.8	89.7	+71.2	6	+3
Colombo	30.6	+1.0	25.9	+0.7	80	86	6.7	250.2	+38.6	21	—1
Diyatalawa	25.8	+0.5	17.8	+0.4	68	84	5.6	59.4	+13.2	7	—1
Galle	29.2	+0.6	24.9	+0.2	89	93	6.5	361.7	+141.5	25	+3
Hambantota	30.4	+0.2	25.4	+0.4	78	86	6.6	170.4	+115.3	11	—1
Jaffna	31.0	+0.6	27.7	+0.5	77	81	6.4	6.4	—9.9	5	+4
Kandy	28.4	+0.6	22.3	+019	68	81	6.8	84.3	—100.4	22	+4
Kankesanturai	33.2	—	27.3	—	70	83	5.6	1.8	—12.4	4	+3
Katunayake	30.6	—	25.4	—	68	78	6.6	205.7	—	20	—
Kurunegala	30.8	+0.5	24.9	+0.6	77	88	6.7	114.6	—48.7	24	+3
Maha Illuuppallama....	33.0	—	24.9	—	64	84	6.4	13.5	—	6	—
Mannar	31.3	+0.2	27.3	+0.2	77	83	6.4	20.3	+15.5	3	+2
Nuwara Eliya	19.0	+0.3	14.2	+0.9	86	89	100.3	100.3	—165.9	21	—3
Puttalam	31.2	+0.8	26.4	+0.1	77	85	6.2	126.7	+103.6	8	+2
Ratmalana	30.7	—	25.5	—	71	78	6.9	243.8	—	20	—
Ratnapura	31.1	+0.7	23.7	+0.1	81	95	7.0	527.8	+65.3	29	+3
Trincomalee	33.9	+0.2	26.4	+0.2	62	76	5.8	181.1	+162.6	6	+4
Vavuniya	34.1	—	25.2	—	62	84	6.2	39.1	+27.2	7	+6

JULY 1973

Station	Temperature			Humidity			Cloud Amout	Rainfall				
	Mean Max.	Departure	Mean Min.	Departure	Day	Night		Amount mm.	Departure	Rain days	Departure	Daily Mean Sun shine
Anuradhapura	33.7	+1.0	24.6	+0.3	64	91	4.8	104.9	+73.1	11	+8	—
Badulla	31.3	+1.1	19.4	+1.4	59	84	5.6	220.2	+170.9	13	+6	—
Batticaloa ..	34.3	+1.1	25.8	+0.8	62	76	5.0	9.9	—27.9	2	—2	8.4
Colombo ..	34.4	+1.1	25.7	+0.8	78	86	6.6	91.7	—48.0	14	—1	5.8
Diyatalawa ..	26.3	+0.8	17.8	+0.8	65	79	5.6	37.1	—21.6	10	+1	—
Galle ..	29.0	+0.8	24.2	+0.6	90	95	5.4	239.0	+68.3	22	+3	—
Hambantota ..	30.3	—0.4	25.2	+0.5	78	86	6.1	17.8	—25.4	8	+1	6.8
Jaffna ..	31.0	+0.9	27.2	+0.6	76	82	6.2	16.8	+0.3	3	+1	—
Kandy ..	28.7	+1.5	21.5	+0.5	68	82	6.2	121.9	—32.5	14	—2	6.4
Kankesanturai ..	33.0	—	26.6	—	70	85	5.8	48.3	+29.8	3	+1	7.4
Katunayake ..	30.7	—	25.1	—	69	80	6.2	91.4	—	11	—	—
Kurunegala ..	31.0	+0.8	24.6	+0.6	74	88	6.2	162.1	+50.3	14	—3	—
MahaIlluppallama	33.5	—	24.4	—	60	82	5.6	54.1	—	10	—	7.7
Mannar ..	31.3	+0.7	26.4	+0.2	76	85	6.0	1.5	—5.6	2	+1	—
Nuwara Eliya ..	19.7	+1.2	13.3	+0.5	83	88	6.0	120.4	—102.1	22	0	—
Puttalam ..	31.9	+1.7	25.8	+0.1	75	89	5.8	15.2	—1.8	4	+1	—
Ratmalana ..	30.4	—	25.0	—	70	82	6.4	156.0	—	14	—	—
Ratnapura ..	31.4	+1.1	23.8	+0.3	76	93	6.6	221.2	—85.4	22	—2	—
Trincomalee ..	34.1	+0.4	26.0	+0.4	62	76	5.6	13.2	—40.9	5	+1	8.6
Vavuniya ..	34.8	—	24.5	—	59	86	6.3	125.0	+98.1	11	+8	—

METEOROLOGICAL REPORT

AUGUST 1973

Station	Temperture				Humidity		Cloud Amou	Rainfall				
	Mean Max.	Departure	Mean Min.	Departure	Day %	Night %		Amount mm.	Departure	Rain days	Departure	Daily Mean Sun shine Hours
Anuradhapura ..												
Badulla ..	31.3	—1.7	24.1	—0.1	68	88	6.2	55.9	+9.2	5	0	—
Batticaloa ..	28.9	—1.2	18.8	+0.6	64	89	6.5	52.3	—43.7	5	—4	—
Colombo ..	33.7	+1.2	25.2	+0.4	62	78	6.0	58.7	—3.0	6	0	6.3
Diyatalawa ..	29.7	+0.3	25.3	+0.3	77	84	6.8	56.4	—67.3	15	0	5.9
Galle ..	24.9	—0.6	17.1	+0.5	66	84	6.1	56.6	—32.8	6	—4	—
Hambantota ..	27.8	—0.3	24.4	—0.5	88	88	6.0	128.5	—50.3	15	—4	—
Jaffna ..	31.3	+0.8	24.8	+0.2	69	82	6.2	7.1	—35.1	4	—4	6.2
Kandy ..	29.8	—0.3	26.3	0	77	82	6.6	90.4	+58.9	8	+4	—
Kankesanturai ..	26.9	—0.9	21.4	+0.4	70	80	7.4	128.5	—13.5	27	+13	4.4
Katunayake ..	31.1	—	25.4	—	76	89	6.4	131.1	+94.0	9	+6	6.8
Kurunegala ..	30.4	—	24.9	—	66	75	6.6	45.2	—	15	—	—
Mahailluppallama	29.9	—0.5	24.2	+0 3	75	88	6.8	72.4	—42.7	18	+2	—
Mannar ..	32.2	—	23.9	—	60	82	6.5	31.0	—	5	—	6.4
Nuwara Eliya ..	29.9	+0.7	25.8	—0.1	79	86	6.6	36.8	+20.8	5	+3	—
Puttalam ..	16.9	+2.1	13.0	+0.4	90	91	7.6	179.8	+0.2	24	+2	—
Ratmalana ..	30.9	+0.5	25.3	—0.3	74	86	6.2	5.3	—16.0	2	—2	—
Ratnapura ..	29.6	—	24.9	—	68	77	6.8	70.4	—	14	—	—
Trincomalee ..	30.2	—0.2	23.4	0	78	93	7.3	241.6	—86.1	27	+3	—
Vavuniya ..	32.7	—0.8	25.6	+0.3	71	76	6.0	108.7	+5.8	7	0	6.7
	32.0	—	23.9	—	62	84	6.8	35.6	—32.7	3	—3	—

SEPTEMBER 1973

Station	Temperture				Humidity		C'oud Amou	Rainfall				
	Mean Max.	Departure	Mean Min.	Departure	Day %	N'ght %		Amount mm.	Departure	Rain days	Departure	Daily Mean Sun shine Hours
Anuradhapura ..	32.9	—0.5	24.0	0	65	88	5.6	70.6	+1.0	9	+4	—
Badulla ..	30.3	+0.4	17.8	—0.2	60	89	5.2	96.3	+3.6	10	+1	—
Batticaloa ..	32.3	+0.2	24.5	—0.1	68	84	5.8	70.4	+22.6	8	—3	7.8
Colombo ..	31.0	+1.4	25.2	+0.5	74	86	6.2	40.4	—113.0	7	—10	7.3
Diyatalawa ..	26.0	+0.6	15.4	—0.7	64	86	4.6	99.1	+4.6	7	—4	—
Galle ..	28.9	+0.7	25.1	—0.2	86	86	4.9	157.5	—21.8	14	—5	—
Hambantota ..	30.6	+0.4	24.8	+0.2	73	84	5.5	27.9	—17.6	6	—2	7.8
Jaffna ..	30.2	0	26.3	—0.1	77	82	6.2	51.0	+3.5	4	+1	—
Kandy ..	29.0	+1.2	19.7	0	63	85	5.6	46.7	—75.5	9	—3	7.4
Kankesanturai ..	32.1	—	25.6	—	73	86	5.8	71.4	+21.1	6	+2	7.8
Katunayake ..	31.8	—	24.5	—	63	79	5.9	40.9	—	7	—	—
Kurunegala ..	32.0	+1.0	24.1	+0.5	66	86	5.5	46.7	+62.5	9	—5	—
Mahailluppallama	33.6	—	24.1	—	57	82	5.7	118.9	—	7	—	—
Mannar ..	30.3	+0.5	25.9	—0.2	80	86	6.4	76.2	+52.6	4	+2	—
Nuwara Eliya ..	20.2	+0.8	11.9	0	77	88	5.9	36.1	—129.0	11	—9	—
Puttalam ..	32.2	+1.5	25.8	+0.2	75	86	5.8	1.3	—34.0	3	—1	—
Ratmalana ..	30.3	—	24.3	—	68	82	6.2	35.6	—	11	—	—
Ratnapura ..	32.1	+1.4	22.7	—0.4	71	95	5.6	153.7	—161.3	15	—7	—
Trincomalee ..	33.9	+0.4	25.2	+0.1	62	78	5.8	54.4	—34.5	8	+2	7.5
Vavuniya ..	33.6	—	23.7	—	66	86	6.2	116.8	+37.8	10	+4	—