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RESEARCH RESULTS AND PRACTICAL EXPERIENCES REGARDING WEED CONTROL IN PEANUTS IN SURINAME

R. E. Dumas and S. Ausan

Agricultural Experiment Station, Paramaribo

SUMMARY

Crop information relevant to weed control and weeds prevalent in peanut plantings are mentioned. Pre-planting and post-planting weed control treatments are discussed. Prior to planting attention should be focussed on effective control of perennial weeds and proper soil cultivation in order to reduce potential weed regeneration. Subsequently an adequate pre-emergence herbicide treatment should be practiced in preference to mechanical control to combat weeds in the crop. However, no herbicide treatment has been found for season-long control under the prevailing weather conditions in Suriname. Of the herbicides tested alachlor (1.70 - 2.60 ≠[x]) has proven to be most appropriate. Very clean fields at harvest are obtained if hilling is practiced at about 4 weeks after sowing in addition to pre-emergence herbicide use. In general no adverse effects on the crop have been recorded, neither quantitatively nor qualitatively, following proper pre-emergence herbicide use. Compared with mechanical weeding, either by hand-hoe or machine equal or better yields have been obtained, the effect of hilling being slightly beneficial at best. Time recordings have shown that the total labour requirement for the traditional method of land preparation, weeding and hilling can be reduced from about 700 man hours/ha to 80-100 man hours/ha if small machines and herbicides are used.

[x]≠ : kg active ingredient per ha

INTRODUCTION

The first experiments with a pre-emergence herbicide were conducted in 1952. It was found that conventional hoeing could be replaced by pre-emergence spraying of 12.5 l Dow Premerge dissolved in 800 l water per ha provided moderate or heavy rains did not fall within 10-14 days from sowing (Ter Horst, 1958). In those days the treatment was frequently used in experiments with grain legumes.

Research on weed control in peanuts was resumed in 1967. Several herbicides were tested: linuron, cycluron, 2.4–DEP, diuron, 2,4–D amine and NPE. The best results were obtained with NPE (2.90 ≠) and 2.4–DEP (3.40 ≠). In combination with inter-row cultivation and hilling the treatments were effective for 2 months: they were more effective than inter-row cultivation and hilling only. Both chemicals caused temporary damage to the seedlings and showed reduced effectiveness under wet weather conditions (Groenendijk, 1967).

In 1972 it was found necessary to establish a weed control division at the Agricultural Experiment Station in order to do regular work on this subject. Up to now the division has

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Nov. 13 - 18, 1978

been mainly engaged in chemical weed control. Research on mechanical weed control is being carried out mainly by another institute which was founded in 1966, namely Celos (Centre for Agricultural Research in Suriname). Research results and practical experiences of both institutes are summarized in this paper. General information on peanut growing in Suriname has been reported elsewhere (Ahlawat and Samlal, 1978).

CROP INFORMATION

Matjan, the cultivar recommended in Suriname, belongs to the Spanish type. Compared with other Spanish type cultivars it has large leaves and large seeds (Wienk, 1978). The optimum plant density has proven to be about 110.000 plants per ha, both in the coastal plain (Ter Horst, 1978) and in the interior (Wienk, 1978). The growth duration is about 100 days. The seeds are usually sown at a depth of 3-4 cm. Seedling emergence normally starts 4-5 days after sowing. After emergence plants develop slowly until about 4 weeks after sowing (fig. 1). It is not known if this is a varietal characteristic or caused by environmental conditions. Flowering starts about 25 days after sowing and the first pegs appear 4 days later. At about this time the canopy starts to develop faster and at a plant spacing of 45 x 20 cm closing of the canopy takes place at 7 to 8 weeks after sowing. From this time on the crop should be able to suppress weeds properly. In a variety trial in the interior (Coebiti), using a plant spacing of 50 x 15 cm, it was found that Matjan provided a better ground cover than the other selections tested (Bink, 1976). Unfortunately Matjan proves to be very susceptible to *Cercospora* leaf spot and peanut rust *(Puccinia arachidis)*. Timely control of these diseases should be pursued in order to prevent premature defoliation which in turn could stimulate weed growth (Bink, 1975). Insect pests, e.q. *Stegasta basquella* (Dumas and Ausan, 1976) and the rate of liming (Muileboom-Muffels, 1975) were also encountered as factors which influence canopy closing. An experiment on a moderately fertile very fine sandy loam indicated that the critical period of weed competition in a wet growing season starts between 6 and 8 weeks after sowing (Oomkes, 1978). A significant yield reduction (54%) compared with the weed-free control was obtained in the case of no weeding only. *Digitaria spp.* and *Eleusine indica* were the predominant weeds. Light was supposed to be the main competitive factor Quantitative and qualitative effects of the weeding treatments on the yield in this experiment are summarized in table 6.

WEEDS

Coastal plain

More than 60 genera were found during a recent weed survey (Dumas and Ausan, 1978) carried out in peanut plantings of 60 farmers in the Saramacca and Commewijne districts where the important peanut growing areas are situated.

Ranked in decreasing order of occurrence *Digitaria spp., Phyllanthus spp., Jussieua spp., Eleusine indica, Alternanthera spp., Lindernia crustacea, Emilia sonchifolia, Eriochloa polystachya, Kyllinga spp.*, and *Fimbristylis spp.* appeared to belong to the first 10 most widespread weeds in the Saramacca district. Of these *Digitaria, Phyllanthus* and *Lindernia* prevailed more often than the other weeds.

A slightly different weed composition was encountered in the Commewijne district, probably because the peanut soils there are somewhat higher than in the Saramacca district. Here, again in decreasing order of occurrence, the following most widespread weeds were encountered:

Phyllanthus spp., Cleome spp., Alternanthera spp., Portulaca oleracea, Spigelia anthelmia, Eleusine indica, Digitaria spp., Commelina virginica, Croton spp., Emilia sonchifolia and *Kyllinga spp.* There were no obvious differences as to the frequency of predominance of the weeds.

— **Interior**

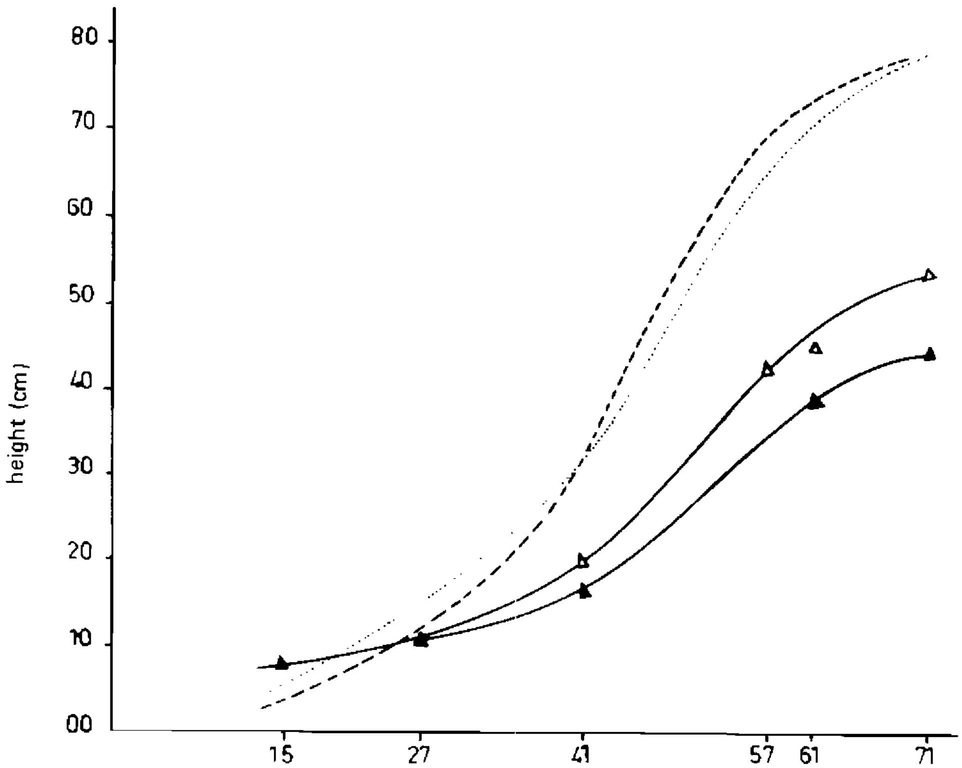
Bink (1975) reported the presence of *Cyperus sp., Digitaria horizontalis, Eleusine indica, Mariscus ligularis, Paspalum conjugatum, Alternanthera sessilis, Amaranthus dubius, Borreria latifolia, Croton miquelianus, Emilia sonchifolia, Euphorbia hirta, Euphorbia hypericifolia, Euphorbia thymifolia, Oldenlandia corymbosa, Physalis angulata, Portulaca oleracea* and *Vernonia cinerea* in a peanut experiment at the Coebiti Experimental Farm. *Eleusine indica* predominated within the group of grasses and sedges, whereas *Alternanthera sessilis, Borreria latifolia, Euphorbia hypericifolia, Euphorbia hirta* and *Physalis angulata* were predominant within the group of broad-leaved weeds. Budelman and Ketelaars (1974) reported the presence of *Lindernia crustacea, Jussieua erecta* and *Andropogon bicornis* at Coebiti as well. Recent information mentions *Eleusine indica* being by far the most predominant weed followed by both *Physalis angulata* and *Amaranthus sp.* (Wienk, 1978).

— **General remarks**

Most weeds found within the experimental area in the interior are common weeds in peanut plantings in the coastal plain. The predominant weeds differ from site to site within one area.

Of the weeds mentioned particular attention has to be paid to *Digitaria* and *Eleusine*, the two most widespread grasses in peanut plantings.

Due to their growth and rooting habit they should be considered most competitive to the crop and most troublesome at harvest. Fig. 1 shows that both grasses start overtopping peanut plants at 3-4 weeks after sowing.



Graphs showing the mean height of *Digitaria spp* (············), *Eleusine indica* (- -- - -) and peanut plants (*A. hypogaea* L. Gv. Matjan) in weed (▲——▲) and not weeded (△——△) plots at different times after sowing (Oomkes, 1978).

Of the broad-leaved weeds *Alternanthera* should be watched carefully. Although most probably less competitive it may infest fields quickly as it propagates easily, both vegetatively and by seed. Another weed with similar characteristics is *Aneilema* which infested the Tijgerkreek-West Experimental Farm badly within 3 years. *Amaranthus* may leave its modest position in the coastal plain as soon as liming is adopted by the farmers as a cultural practice.

WEED CONTROL TREATMENTS

– **Pre-planting**

• Mechanical

The traditional method of preparing the field usually starts with weeding by cutlass. Subsequently the debris is burnt, removed or worked into the soil during cultivation which consists of hand-forking. Mostly some kind of levelling is done by means of hand tools prior to sowing. It is estimated that 400-500 man hours/ha are needed for these operations.

Weeding by cutlass prior to soil cultivation is still practiced where a heavy vegetation is present although two-wheeled tractors, which are widely used now for soil cultivation, may be equipped with a rotary cutter. Vollebregt (1972) reported a very good performance of this implement, but Schipper (1972) mentioned that it failed on uneven land. The nett labour requirement for the use of the rotary cutter is supposed to be about the same as that for rotavating. According to Vollebregt (1972) the latter requires about 19 man hours/ha.

In practice most farmers rotavate their land 1-3 times to a depth of 5-7 cm. The second cultivation takes place 1 to 2 weeks after the first one, when weeds have emerged. The third cultivation is carried out mostly if weeds are not sufficiently destroyed. Use of an interval of about 10 days between two cultivations proved effective to control volunteer plants of previous crops (Van Der Sar, 1976).

Numerous data on the influence of the primary soil cultivation on weediness afterward. were compiled by Celos research workers.

As a rule it was found that initial weed regeneration decreased with increasing working depth (5 to 25 cm) of the primary soil cultivation. The effect was greater when the soil was turned (mouldboard plough) than when it was mixed (rotavator) (e.g. Kouwenhoven, 1973; Klay 1976; Vermeulen, 1975; Van Der Sar, 1976).

- Chemical

Instead of weeding by cutlass or mowing by machine the existing weed cover could be cleared chemically some time prior to soil cultivation.

Of the herbicides available to farmers paraquat is most popular. Experiences suggest that a slower but better killing effect is obtained if this herbicide is sprayed in cloudy weather or towards the evening. Further improvement of effectiveness has been experienced if 2,4-D was added to the spray solution.

Beside a better control of several troublesome grasses (e.g. *Eriochloa polystachya),* the mixture proved very useful to prevent climbers from becoming predominant which may happen after regular spraying with merely paraquat (Dumas and Schut, 1976). Disappointing results have been obtained with mixtures of paraquat and dalapon, probably due to reduced dalapon activity. Very satisfactory control of mixed weed populations has also been observed after the use of dalapon in conjunction with 2,4-D; the main disadvantage is that rain shortly after spraying washes off both chemicals.

Although very useful for perennial grass control, dalapon is by far not as appreciated by farmers as paraquat, since mostly 2 sprayings at a relatively short interval are needed. Moreover it may take a long time before it exhibits its killing effect. At present glyphosate is being introduced in Suriname. Due to its high price its use will probably be restricted to very troublesome perennial weeds. Proper chemical control of perennials prior to soil cultivation should be preferred to merely mechanical control if it is to be expected that they will be a nuisance in the crop. This also holds if a pre-emergence herbicide will be used later on.

Pre-emergence herbicides are in most cases not suited to control weeds which emerge from vegetative parts.

Minor attention has been paid so far to pre-planting use of pre-emergence herbicides. Benfluralin 0.75-2.25 ≠, trifluralin 0.50-1.50 ≠, nitralin 0.75 ≠, trifluralin 0.44 ≠ + 2,4-D amine 1.44 ≠, trifluralin 0.44 ≠+ linuron 1.00 ≠, trifluralin 0.44 ≠+ prometryne 1.00 ≠ and nitralin 0.75 ≠ + 2,4-D amine 1.44 ≠ incorporated into the soil immediately after application gave unsatisfactory weed control.

The labour requirement for spraying operations, excluding an allowance for personal needs, varies from 14-27 man hours/ha, dependent on knapsack sprayer characteristics, the way of spraying, etc.

– **Post-planting**

• Mechanical

The traditional method of weeding comprises hand-hoeing followed by hilling. According to Ter Horst (1958, 1959) 256 man hours/ha are needed of which 96 man hours are required for hilling.

In general a row width of about 50 cm is supposed to be adequate for control by machines. An experiment where interrow cultivation was carried out at 45 cm row width at 4 weeks after sowing by means of a two-wheeled tractor mounted with a two-row rotavator showed that weeds and peanut plants were too advanced resulting in poor weed control and some crop damage. A nett labour requirement of 16 man hours/ha was recorded for this operation. Better control was obtained where hilling was practiced in addition to inter-row cultivation although some grasses persisted in the plant rows. It should be stressed that hilling should be done at the proper time, i.e. when weeds are still small enough to bury them completely. In practice almost all peanut farmers still carry out hilling by hand-hoe at about 4 weeks after sowing, just after weeding. In order to cut the labour requirement efforts have been made by Celos research workers to mechanize this operation. Use of a two-wheeled tractor fitted with 2 ridgers required 13 man hours/ha (6½ machine hours/ha). The work being strenuous, 2 drivers were required. They relieved each other after about half an hour (Klay, 1975). Another approach was necessary to ease the driver's job.

This led to the construction of a multi-purpose toolbar with seat and wheels, which was fitted to a two-wheeled tractor changing it into a four-wheeled one (fig. 2). Rhebergen (1976) reported that the machine performed very well in practice. Hoeing in the third gear with duckfoot shares and angle blades in cowpeas required 5½ machine hours/ha. A minor degree of clogging was observed, however, if the fourth gear was used. A nett labour requirement of 4½ machine hours/ ha was recorded for hilling peanuts at 4 weeks after sowing, carried out in the fourth gear with 2 ridgers. The operation failed on too wet a soil.

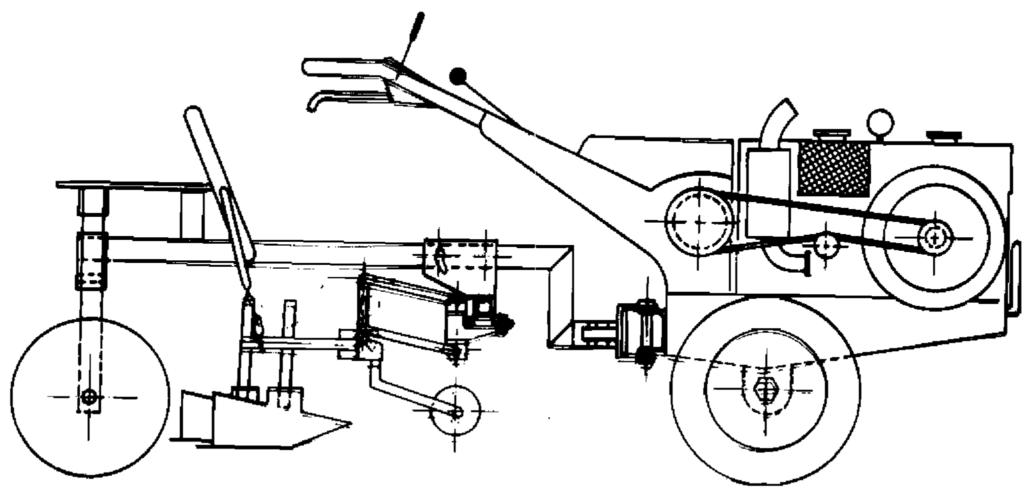


Fig.2. Multi-purpose toolbar with seat and wheels fixted to a two-wheeled tractor (After Rhebergen, 1976)

• Chemical

One of the objectives of the Weed Control Division of the Agricultural Experiment Station has been to find a herbicide treatment for peanuts which gives season-long weed control. In addition to the earlier mentioned pre-planting pre-emergence treatments the following post-planting pre-emergence treatments were tested:

alachlor 1.50-4.50 ≠, chlorthal 5.00-15.00 ≠, diphenamid 2.75-8.25 ≠, nitrofen 1.10-3.30 ≠, prometryne 0.50-1.50 ≠, propachlor 3.30-9.90 ≠, sulfallate 3.30-9.90 ≠, ametryne 2.40 ≠, linuron 1.00 ≠, methazole 1.00-1.87 ≠, ametryne 0.80 ≠ + prometryne 0.75 ≠ and linuron 1.00 ≠ + nitralin 1.50 ≠. The last mentioned treatment was tested in a very dry season only. Of the remaining treatments it can be said that none of them gave adequate season-long control under normal or wet weather conditions. Most screening work was done at the Tijgerkreek-West Experimental Farm on a fine sandy loam.

Information on the performance of the herbicides involved in prolonged experiments may be summarized as follows.

Alachlor. Up to now alachlor proved to be the best of all treatments tested. An application rate of 1.70-2.60 ≠ is recommended.

The chemical is spread very well by rain. It gives adequate control of both grasses and broad-leaved weeds under different weather conditions. Season-long control, i.e. without hilling or additional weeding, was obtained in a very dry season only. Normally an effective period of at least 6 weeks may be expected (table 1). Poor early post-emergence activity and the slightly too short a residual effect are the main defects of the chemical.

Table 1 – Mean visual scores for hand-hoeing and for several pre-emergence herbicide treatments with and without hilling at 4 weeks after sowing.

Sub-treatment	weeks after sowing	hand-hoeing					alachlor					diphenamid					methazole					prometryne				linuron + nitralin					
							+ 1.54	1.83	2.94	2.80	2.45	3.20	3.66	4.57	4.80	–	1.00	1.05	1.20	–	1.58	1.00	0.97	1.29	1.25	–	–	–	–	–	100 + 1.50
	4	–	–	–	4.4	4.9++	6.5	6.5	8.1	8.1	8.9	4.0	5.5	8.1	7.6	–	5.0	4.8	7.9	–	7.0	8.3	7.0	8.6	8.1	–	–	–	–	–	7.5
no	5	–	–	–	8.9	–	6.5	–	7.6	7.6	–	3.0	–	4.8	6.8	–	4.0	–	7.3	–	–	6.5	–	7.9	7.3	–	–	–	–	–	–
hilling	6	–	–	–	–	4.3	–	5.0	–	–	7.9	–	5.0	–	–	–	–	2.0	–	–	5.3	–	3.3	–	–	–	–	–	–	–	7.1
	8	–	–	–	7.3	4.3	5.0	5.0	7.0	6.3	7.4	–	3.5	4.3	5.4	–	2.8	2.0	5.8	–	5.3	6.5	4.0	7.1	5.6	–	–	–	–	–	7.3
	4+++	–	–	4.3	4.6	4.7	8.5	6.5	8.1	8.4	9.1	4.0	5.5	6.1	7.7	–	5.0	4.8	7.9	–	8.9	8.3	7.0	8.6	8.1	–	–	–	–	–	7.5
plus	5	9.5	–	9.4	9.5	–	9.8	–	9.5	9.6	–	9.5	–	9.5	9.6	–	9.5	–	9.8	–	–	9.8	–	9.8	9.6	–	–	–	–	–	–
hilling	6	–	8.8	–	–	7.9	–	9.5	–	–	9.5	–	9.3	–	–	–	–	8.8	–	–	8.7	–	9.0	–	–	–	–	–	–	–	9.3
	8	7.9	7.3	7.3	7.9	7.4	8.5	9.5	8.5	9.1	9.1	8.3	8.3	7.3	8.6	–	7.8	8.0	7.6	–	7.9	9.0	8.3	8.4	8.0	–	–	–	–	–	9.2

\+ herbicide rates in kg active ingredient per ha
++ score prior to inter-row rotavating (instead of hand-hoeing)
+++ scores prior to hilling by hand-hoe

Visual scoring: 1 = plot completely occupied
10 = plot completely weed – free

The former is being met by adding some paraquat to the spray solution.

Diphenamid. The chemical gave excellent control of grasses but poor control of broad-leaved weeds. This has also been experienced by Muileboom-Muffels (1975) who used the herbicide in the interior.

An application rate of at least 4.80 ≠ seems necessary to obtain reasonable control for nearly 6 weeks (table 1).

Methazole. Varying results were obtained but in general the herbicide proved to be usable. The appropriate rate for peanuts is 1.20-1.50 ≠, giving reasonable control for about 6 weeks (table 1).

Reduced effectiveness was observed under wet conditions. Grasses, particularly *Eleusine indica* and some broad-leaved weeds e.g. *Aneilema sp., Phyllanthus amarus* are poorly controlled. Experiences suggest that better control is obtained if methazole is used early post-emergence (but prior to crop-emergence) instead of pre-emergence.

Prometryne. As with methazole poor grass control and reduced effectiveness under wet conditions are the main defects, bug broad-leaved weed control is generally better than from the other herbicides mentioned. Under normal Surinam weather conditions a rate of 1.25 ≠ will give adequate control for about 6 weeks (table 1). Better control may be expected if prometryne is applied early post-weed-emergence but pre-crop-emergence as it then also kills weeds (e.g. *Eleusine indica),* which usually appear shortly after pre-emergence use.

Linuron + nitralin. The performance of this combination was observed in one (dry) season only, but the individual components were tested earlier under wet conditions. Linuron (1.00 ≠) gave poor grass control whereas nitralin (0.75 ≠) exhibited the reverse effect. The combination, using an increased rate for nitralin (1.50 ≠), performed well (table 1) and was almost equally effective as alachlor, the main difference being far better control of *Aneilema* by alachlor. However, the combination seemed to have a slightly better residual effect than alachlor, but this should be confirmed yet under normal and wet weather conditions.

• Chemical plus hilling

As mentioned earlier hilling is a common practice in peasant peanut farming. If done at the right time it has the advantage of controlling weeds effectively both within and between the plant rows. Moreover it seems to ease harvesting both by hand by peanut lifter. The hilling operation is time-consuming if done by hand-hoe but there are possibilities now to do it by machine. Experiments and observational plantings where hilling was practised as an additional weeding treatment at about 4 weeks after sowing showed that weed control effectiveness was considerably improved (table 1). Strikingly clean fields at harvest were obtained where the use of a good pre-emergence herbicide was followed by hilling.

EFFECTS ON THE CROP

– Seedling emergence

As to the main pre-emergence herbicide treatments no effect was noticed on seedling emergence using not pre-germinated seed and a sowing depth of about 5 cm. Results of two field experiments are given in table 2. Figures are treatment means of 4 replications.

Table 2 — Percentage emergence 8 days after sowing.

Treatment	Experiment no. TK 75	TK 103
no herbicide	90.1	84.2
alachlor 2.80 #, 2.45 #	88.4	84.6
diphenamid 4.80 #	89.0	—
methazole 1.58 #	—	84.2
prometryne 1.25 #	87.9	—
linuron 1.00 # + nitralin 1.50 #	—	84.9

Muileboom-Muffels (1975) who applied prometryne (1.25 ≠), diphenamid (5.60 ≠) and paraquat (0.5% spray solution) pre-emergence in the interior found no appreciable differences in seedling emergence under wet conditions after the use of not pre-germinated peanut seed at a sowing depth of 3-4 cm.

Research on the influence of sowing depth with use of alachlor is still in progress. The results of two field experiments with peanuts have been mentioned in table 3. Figures are treatment means of 5 replications. Alachlor was applied not later than one day after sowing.

Table 3. Percentage emergence as affected by sowing depth and alachlor under dry and wet weather conditions.

sowing	dry conditions						wet conditions					
depth	no herbicide			alachlor 2.58 #			no herbicide			alachlor 2.58 #		
	5+	12	19	5	12	19	5	14	19	5	14	19
2.5 cm	15	29	39	12	31	40	55	81	81	56	77	77
5.0 cm	28	69	80	22	68	77	37	82	82	24	67	68

+ days after sowing

Alachlor did not affect seedling emergence significantly at both sowing depths under both weather conditions. The figures suggest that there might be a slight depressive effect if wet conditions prevail following deep sowing and the use of alachlor. However, this supposition is not confirmed by earlier results from a weed competition experiment (Oomkes, 1978) where alachlor had been used under similar conditions. The above mentioned figures demonstrate clearly how seedling emergence is influenced by both sowing depth and weather conditions. In this experiment the depressive effect of deep sowing under wet conditions disappeared at 9 days after sowing. It is worth reminding that in practice peanut farmers use a sowing depth of 3 – 4 cm.

— **Visual damage**

Normally no damage to the plants should occur where alachlor is used pre-emergence at the recommended rates.

Shorter plants were observed where wet weather conditions prevailed immediately after application of the highest rate recommended. Other damage symptoms such as yellowing and scorching of the leaf margins, particularly along the leaf top as expressed by e.g. cowpeas (Dumas and Ausan, 1977) usually are rare. In most cases normal or better developed peanut plants may be expected following the use of alachlor.

Pre-emergence use of methazole at 1.58 ≠ caused yellowing of the older leaves at about 2 weeks after sowing. Yellowing and some stunting of the plants were observed after pre-emergence application of 1.87 ≠ during wet conditions. Damage is usually temporary at the highest rate recommended.

Crop injury was also noticed at about two weeks after sowing where linuron 1.00 ≠ plus nitralin 1.50 ≠ were used pre-emergence. The symptoms were restricted to the older leaves exhibiting yellow spots, local curling and die-back. The injury was short-lived.

No visual damage was observed after pre-emergence use of prometryne or diphenamid at the rates applied.

— **Yield**

Compared with mechanical weeding, either by hand-hoe or machine, equal or better yields were obtained where pre-emergence herbicides had been applied. The results from two split-plot experiments where hilling at 4 weeks after sowing and no hilling at all had been arranged as sub-treatments, have been summarized in table 4. Figures are treatment means of 4 replications.

Table 4 — Pod yields (kg/are) from two weed control experiments in peanuts.

main weeding treatment	Exp. TK 75* hilling		Exp. TK 103++ hilling	
	—	+	—	+
hand-hoeing at 4 weeks	19.6	20.0		
inter-row rotavating at 4 weeks			16.8	19.9
alachlor 2.80 ≠ and 2.45 ≠	20.8	22.7	30.8	29.9
diphenamid 4.80 ≠	22.0	23.2		
methazole 1.58 ≠			19.9	24.8
prometryne 1.25 ≠	20.4	22.0		
linuron 1.00 ≠ + nitralin 1.50 ≠			26.1	26.2

* sun-dry pods
++ pods at 12% m.c.

In both experiments hilling tended to be beneficial (significant at the 10% level) irrespective of the main weeding treatment. Muileboom-Muffels (1975) found no significant yield differences following pre-emergence use of prometryne, diphenamid and paraquat (+ weeding at 3 weeks) in the interior (table 5). She recorded a slight beneficial effect of hilling only where prometryne was used (significant at the 10% level). It was supposed that this might be due to the relatively high percentage of inter-row space covered by weeds at this herbicide.

Table 5. Quantitative and qualitative data on yield (12% m.c.) from a weed control experiment in the interior (Muileboom-Muffels, 1975).

herbicide		yield (kg/ha)	pods/plant	out-turn (%)	1000 kernels (g)	pods per kg total	partly filled	pops
prometryne	–*	2350	18	74	582	745	59	14
(1.25 #)	+	2650	19	74	616	733	98	18
diphenamid	–	2590	20	74	585	764	97	9
(5.60 #)	+	2700	19	75	606	719	57	21
paraquat	–	2650	20	74	591	752	95	18
(0.5% sol.)	+	2540	18	75	603	701	59	10

* – not hilled
+ hilled

As to the effect of hilling on pod yield variable results have been obtained so far. In two earlier experiments in the coastal plain (Cultuurtuin) Van Dijk and Huiswoud (1966) and Van Dijk (1968) found a small but significant effect on yield, whereas Van Slobbe and Wienk (1973) working in the interior (Coebiti) found no effect, neither quantitative nor qualitative. No weed problem was encountered in the latter case as the experimental area had been reclaimed only recently (1969). The most plausible explanation for these results is that if hilling is carried out in time its effect becomes more pronounced as the level of weed competition increases.

The results from two earlier mentioned experiments are available as to the qualitative effects of the pre-emergence herbicide use on yield. The figures in table 5 are means of two replications, those in table 6 are means of four replications. Alachlor was used here to accomplish a weed-free check.

There were no significant differences, neither between the three herbicide treatments nor between alachlor pre-emergence and the traditional method of hand-hoeing at 4 weeks. Above all the figures in table 6 show the effects of postponing the first weeding treatment in a wet season.

Table 6. Quantitative and qualtitative data on yield (12% m.c.) from a weed competition experiment in the coastal plain (Oomkes, 1978).

treatment	yield (kg/ha)	pods/5 pl	out-turn (%)	1000 kernels (g)	completely filled pods (%)
alachlor 2.58 #	1553	88	64	364	83
1st weeding at 2w.	1578	81	63	363	85
1st weeding at 4w.	1509	82	67	382	82
1st weeding at 6w.	1594	72	65	409	89
1st weeding at 8w.	1220	57	71	399	87
no weeding	708	40	69	395	90

Note: plots were kept as clean as possible from the 1st weeding on up to 8 weeks after sowing.

DISCUSSION

The traditional method of peanut growing is time-consuming requiring about 1500 man hours/ha. Of these about 700 man hours are needed for land preparation, weeding and hilling by hand-hoe. Time recordings have pointed out that the labour requirement for these operations can be reduced to 80 – 100 man hours/ha if small machines and herbicides are used. Machines are particularly valuable for land preparation whereas pre-emergence herbicides should be preferred for weed control in the crop as machines may cause mechanical damage to the peanut plants allowing fungi (e.g. *Aspergillus niger)* to enter and/or may help to spread diseases (Feakin, 1973). An important factor to be considered in Suriname is that the main peanut area is situated in the coastal plain where raised beds are usually necessary for drainage. Use of machines in an established crop on beds is rather unpractical. Peanut growing on the free-draining soils in the interior is still in an experimental stage. However, experiences up to now have pointed out that weed control by merely mechanical means was far from satisfactory (Wienk, 1978).

The effort to suffice with one pre-emergence herbicide treatment without additional weeding or hilling failed under normal and wet weather conditions. The residual effect of the herbicides and herbicide combinations tested was slightly too short resulting in too weedy fields at harvest. It will be interesting to find out if the ultimate aim may be attained by combining pre-emergence herbicide use with a closer plant spacing e.g. 30 x 20 cm, which approximates the plant spacing used by peanut farmers (Veltkamp and Samlal, 1976). An earlier closing peanut canopy might help to suppress weed growth more effectively. Moreover better filling of the kernels might be expected if table 6 is considered more closely. As soon as season-long control is obtained with one herbicide treatment hilling can be omitted, even if it needs only a few hours to do it by machine. In general hilling is not recommended abroad (Feakin, 1973) as it creates favourable conditions for the development of *Sclerotium rolfsii*, a fungus which also occurs in Suriname.

However, up to now no significant differences in the number of plants per plot have been found at harvest in "hilling vs. no hilling" experiments in the coastal plain and in the interior.

Alachlor has proven to be an attractive herbicide for Suriname as it controls most grasses and broadleaved weeds commonly found on regularly cropped land under different weather conditions. There are good prospects to use this herbicide in other crops. This is an important factor to be taken into account in Suriname because of the relatively modest area under cultivation, making it unattractive for commercial enterprises to import a wide variety of herbicides. The more so as they are bound to fixed minimum orders. As the introduction of a herbicide to farmers proceeds slowly (Veltkamp, 1978) one can imagine that kind co-operation of the representing firm will be indispensable.

In order to prevent the build-up of a resistent weed flora as a result of one-sided use of alachlor some more herbicides should be found with comparable or better qualities. These herbicides should be active on different ranges of weeds in order to be able to rotate them as effectively as possible.

The yield figures of the weed competition experiment indicate that rather a post-emergence than a pre-emergence treatment should be applied on peanuts as weed competition starts in the second half of the growth cycle. Moreover peanut fields should be as clean as possible at harvest. Application of a post-emergence treatment implies that the herbicide should be selective and soil-acting as part of the weeds will be protected at spraying by the peanut foliage. Experience on this subject is lacking in Suriname, but the literature (Feakin, 1973) indicates that the number of herbicides available (2,4-DB, 2,4-D ester, MCPB, dinoseb) is far less numerous than for pre-emergence herbicides. This probably means that peanut plants are less tolerant to post-emergence herbicide treatments.

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