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TECHNICAL REPORT No. 30

HERBICIDES FOR THE CONTROL OF THE BROAD-LEAVED DOCK (RUMEX OBTUSIFOLIUS L.)

A.M. Blair and J. Holroyd

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NOTE

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HERBICIDES FOR THE CONTROL OF THE BROAD-LEAVED DOCK (RUMEX OBTUSIFOLIUS L.)

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SUMMARY

The activity of a wide range of herbicides on broad-leaved dock (Rumex obtusifolius L.) has been examined in a series of field experiments between 1963 and 1967 using specially established plants. With few exceptions only plants a few months old were killed. Docks became more resistant with age to activated aminotriazole, but maleic hydrazide was more active as an early spring or autumn treatment and asulam as an autumn treatment irrespective of age. Dicamba and picloram were little influenced by either timing of application or age of plants whereas March and August applications of M & B 8882 seemed to give better control than the other dates of spraying in this series of experiments.

INTRODUCTION

The broad-leaved dock (Rumex obtusifolius) in the seedling stage, before a large tap root has formed is readily killed by any of the herbicides MCPA, 2,4-D, MCPB, 2,4-DB, mecoprop and dichlorprop (Fryer & Makepeace, 1972). However well established plants, particularly in grassland, are more tolerant.

Various herbicides and herbicide mixtures have been tested for their effectiveness on the broad-leaved dock in experiments extending over several years. Some of the results with asulam and M & B 8882 (methyl 4-nitrobenzene sulphonylcarbamate) which were used in this series of experiments have also been reported elsewhere (Blair, 1968).

EXPERIMENTAL PROCEDURE

Plant culture and treatment

All experiments described in this report have been carried out with plants specially raised from seed. Seeds were planted in small fibre pots in mid-April 1963 and raised in the greenhouse before planting out in the field in early July 1963 in a sandy loam over gravel soil. Four or five seedlings were planted out in each plot (0.84 x 0.84 m), the fifth seedling being in the centre of the plot. This design was used so that if in the future the plants grew too large, the outer four could be removed leaving one central plant per plot. This has not been necessary. Management of the area aimed to maintain the original stand and prevent further seedling establishment. This has meant 'topping' the dock plants to about 10 cm above ground level after flowering but prior to seed formation, and at the same time spraying the area with paraquat to clear

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* Herbicide Evaluation Section

any annual or seedling weeds. Thus the plants were grown throughout in the absence of serious competition from other species.

Treatments were applied successively from the autumn of 1963 (Table 1) using a small-plot hand-held sprayer. Experiments 1-5 were sprayed using an Allman 'O' jet delivering 1120 l/ha but from Experiment 6 it was decided to reduce the volume to a more realistic, although still high, rate: an Allman 'OOOO' jet delivering 560 l/ha was used. Good cover of foliage was still obtained but the droplet spectrum was somewhat atypical. In all cases a pressure of 210 kN/m^2 was used, and herbicides were applied as the formulation supplied by the manufacturers for field experimentation (Table 1) and except for 'MOREL 462' were made up in a 0.1% v/v 'Agral 90' solution.

Table 1. Treatments applied at the various dates

Herbicide	Formulation	Experiments in which used								
		1	2	3	4	5	6	7	8	9
ametryne	w.p.	+								
activated aminotriazole	a.c.	+	+	+		+	+		+	
asulam (formulation of acid)	w.p.	+	+							
asulam (potassium salt)	w.s.p.			+	+					+
benazolin	a.c.	+								
carbasulam	w.s.p.		+	+	+					
chlorfenac-sodium	a.c.	+								
chlorflurecol-methyl	e.c.				+	+	+			+
2-chloro-4-fluorophenoxyacetic acid (butyl ester)	e.c.	+								
CP 52089 (confidential)	a.c.						+			
4-CPA-butyl	e.c.	+								
chlorthiamid	granular	+								
2,4-D-ethyl	e.c.	+			+			+		
2,4-D-acetamide	w.p.	+								
2,4-DB-sodium	w.p.	+								
dicamba-dimethylamine	a.c.	+	+	+	+	+	+	+		
dichlorprop-diethanolamine	a.c.	+		+						+
dichlorprop-amide	w.p.	+								
fenoprop-butyl	e.c.	+								
methyl dichlorobenzoic acid (HN 1688)	-	+								
ioxynil-amine	a.c.	+								
isocil	w.p.	+								
maleic hydrazide (diethanolamine salt)	a.c.	+	+	+			+	+	+	+
methyl 4-nitrobenzenesulphonylcarbamate (M & B 8882)	w.s.p.				+	+	+	+	+	+
MCPA-sodium/potassium	a.c.		+	+						+
mecoprop-potassium	a.c.			+						
monolinuron	w.p.	+								
para-chlorophenyl-3 ethyl 5-oxazolidine 2,4 dione (MOREL 462) made up in solution with industrial spirit	-		+	+						
picloram-potassium	a.c.	+	+	+	+	+	+	+		
pyriclor-potassium	w.p.					+				
2,3,6-TBA-sodium	a.c.	+								
tricamba-sodium	a.c.	+								

w.p. ≡ wettable powder
w.s.p. ≡ water soluble powder
a.c. ≡ aqueous concentrate
e.c. ≡ emulsifiable concentrate

In all experiments conditions at spraying were generally favourable. Drift onto adjacent plots was prevented by the use of a hessian windshield which surrounded the plot. The dock plants were generally 22.5-37.5 cm in height at spraying except in the case of Experiment 8 where the plants were very large, about 75.0 cm in height. Each treatment was replicated twice in a randomised block.

Assessments and presentation of results

Effects were assessed using a subjective scoring system for vigour. This system was based on a scale 0-9. A score of 0 indicated no visible top growth, a score of 9 no difference from untreated control. Effects were generally assessed at 2-week intervals for the first 8 weeks of an experiment and thereafter at 3-5 week intervals.

The graphed data (Fig. 1-12) illustrate the results obtained from each application date. These are mainly self-explanatory but a few comments have been made concerning the more effective treatments. Other graphs (Fig. 13-18) show the effect of time of application. When making comparisons between similar treatments in different years it should be remembered that the docks were becoming progressively older and better established throughout, and that the results particularly of the 1963 application on the young plants may vary from the 1966-67 results on 4 year old plants. With such a progressive screen one can gradually eliminate the less effective treatments as the age of the plants increases. All herbicide doses are expressed in terms of active ingredient.

RESULTS

Experiment 1

The results of the treatments applied on 20/9/63 are given in Fig. 1-3. There were several promising treatments at this date on the young dock plants. Those giving almost complete control 2 years after application were: activated aminotriazole @ 2.2 kg/ha, asulam @ 4.5 kg/ha, dicamba @ 1.1 kg/ha, 2,4-D ester + picloram @ 0.3 + o.3 kg/ha, isocil @ 4.5 kg/ha, maleic hydrazide @ 4.5 kg/ha, picloram @ 0.1 kg/ha, 2,3,6-TBA @ 1.1 kg/ha and tricamba @ 4.5 kg/ha. Observations made on selected rootstocks 12 months after spraying are shown in Table 2.

Table 2. Observations on rootstocks 12 months after treatment

Herbicide	Dose (kg/ha)	Observation
picloram	0.1	Rootstocks showing signs of life but no foliage present.
"	0.3	One out of 4 rootstocks showing slight signs of life.
"	0.6	All rootstocks dead.
"	1.1	All rootstocks dead.
tricamba	4.5	Vigorous growth of rootstocks but little sign of foliage.
dicamba	4.5	Only one plant showing signs of growth.
asulam	4.5	Two out of 4 rootstocks healthy - no new shoots.
activated aminotriazole	4.5	Signs of regrowth.
maleic hydrazide	4.5	Rootstocks apparently unaffected.

Experiment 2

Fig. 4 shows the results of treatments applied on 13/5/64.

Only 0.6 kg/ha picloram gave complete kill which was still effective 2 years later. Docks treated with activated aminotriazole @ 4.5 kg/ha, dicamba @ 1.1 kg/ha and picloram @ 0.3 kg/ha were still markedly reduced even after 2 years.

Experiment 3

Fig. 5 and 6 show results of treatments applied on 24/9/64.

When applied in September to 18-month old dock plants maleic hydrazide @ 9.0 kg/ha gave almost complete kill which was maintained for 2 years. Picloram @ 0.6 kg/ha caused severe initial effects but recovery started after about 7 months. Dicamba @ 1.1 kg/ha controlled the docks for about 9 months, after which there was some recovery. Asulam @ 4.5 kg/ha caused a similar degree of kill to dicamba but was much slower to develop.

Experiment 4

Fig. 7 shows results of treatments applied on 13/5/65.

None of the treatments applied on this date had a lasting effect. Asulam @ 4.5 kg/ha, picloram @ 0.3 and 0.6 kg/ha, dicamba @ 1.1 kg/ha and chlorflurecol @ 3.4 kg/ha all caused severe initial reductions but recovery was complete within 2 years.

Experiment 5

Fig. 8 shows results of treatments applied on 2/8/66.

There were some effective treatments at this date. Pyriclor @ 4.5 kg/ha and M & B 8882 @ 4.5 kg/ha were both still giving good control after 16 months. Dicamba @ 1.1 kg/ha and picloram @ 0.6 kg/ha gave good initial control but regrowth occurred.

Experiment 6

Fig. 9 shows results of treatments applied on 11/11/66.

None of the treatments applied on this date gave good lasting control. All plants started regrowing after 5-7 months.

Experiment 7

Fig. 10 shows results of treatments applied on 15/3/67.

M & B 8882 @ 4.5 kg/ha gave very good control of the dock plants for up to 1 year after treatment.

Experiment 8

Fig. 11 shows results of treatments applied on 2/6/67.

Picloram @ 0.6 kg/ha was the only treatment to cause marked reductions of the dock plants although recovery was almost complete within 1 year of treatment. This could be due to the fact that plants were particularly tall at treatment.

Experiment 9

Fig. 12 shows results of treatments applied on 3/10/67.

None of the treatments at this date gave effective control of the docks.

The effect of the same herbicide treatments applied in different seasons and in different years is presented in Fig. 13-18. Picloram (Fig. 18) has given the most consistently good control of the docks under the varying conditions.

DISCUSSION

Many of the herbicides used in this series of experiments now have some practical recommendation for dock control (Fryer & Makepeace, 1972). Which particular treatment is used will depend upon the particular crop situation in which it is desired to control the docks, and also on other factors such as cost in relation to that crop e.g. more expensive treatments could be appropriate to horticultural crops rather than in grassland.

This type of experiment is useful to compare a range of treatments and select herbicides for further investigation, but the situation is artificial in that these plants suffered neither the occasional disturbance associated with arable cropping nor the competition experienced in grassland. Hence it is possible that plants may recover from treatments in this experiment which in other circumstances might be more lethal.

Comparison of similar treatments in different years and in different seasons is further complicated by the differing ages of the plants at treatment. Some of the herbicides in this series of experiments were more affected by time of application than by age of plant at treatment. Maleic hydrazide, for example, markedly reduced the docks when sprayed either in early spring or autumn, but varied little as plants aged. Conversely plants treated with activated aminotriazole seemed to become more resistant with age. Neither age of dock plants nor time of application affected dicamba or picloram except at the last date of application of dicamba.

Permanent control however, with one or two exceptions, was only of plants a few months old and there is still a need for a cheap effective herbicide which can be used particularly in grassland, where docks are still one of the most important 'problem weeds'.

ACKNOWLEDGEMENTS

We wish to thank Dr. K. Holly for help and advice, the many members of WRO who have assisted with the experiments over the years, and the various manufacturers for supplying the herbicides.

REFERENCES

BLAIR, A.M. (1968) The control of Rumex obtusifolius by sulphonyl carbamate herbicides. Proc. 9th Br. Weed Control Conf., 515-19.

FRYER, J.D. & MAKEPEACE, R.J. (1972) Weed Control Handbook, Vol. II. Recommendations. Blackwell Scientific Publications, Oxford, pp. 424.

Fig. 1

The Effect of Various Herbicide Treatments Applied on 20.9.63 (Expt. 1)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

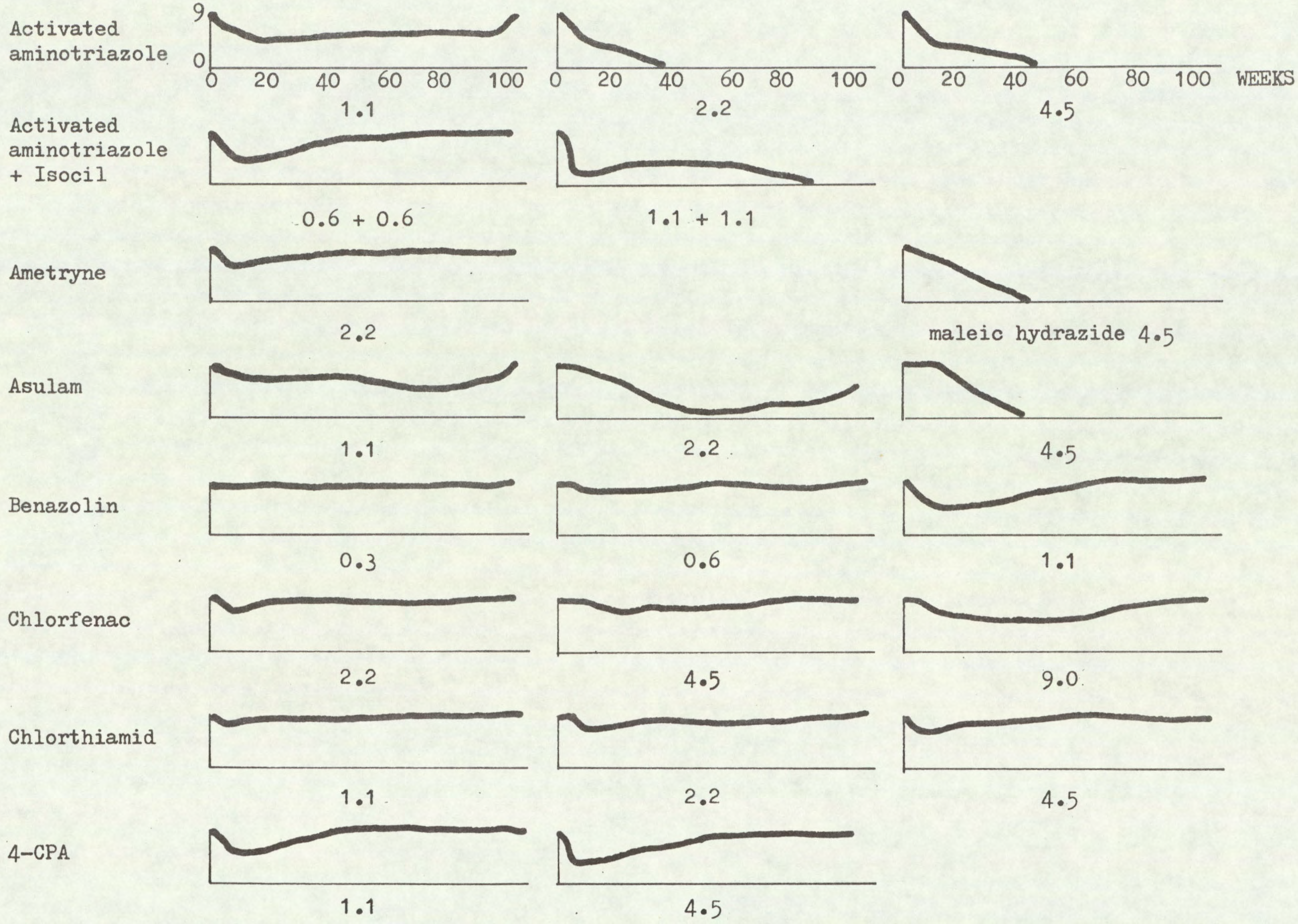


Fig. 2

The Effect of Various Herbicide Treatments Applied on 20.9.63 (Expt. 1)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

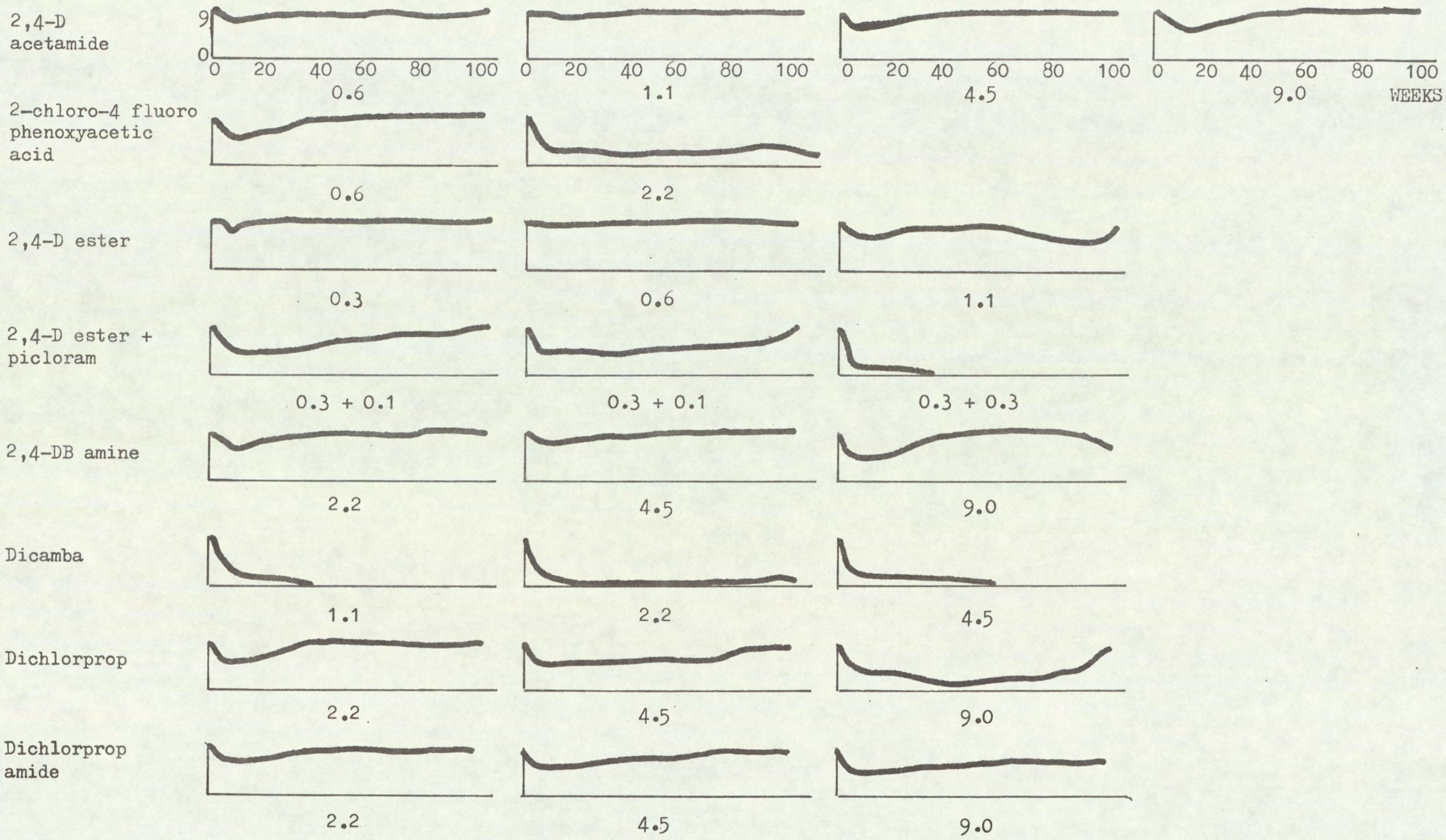


Fig. 3

The Effect of Various Herbicide Treatments Applied on 20.9.63 (Expt. 1)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

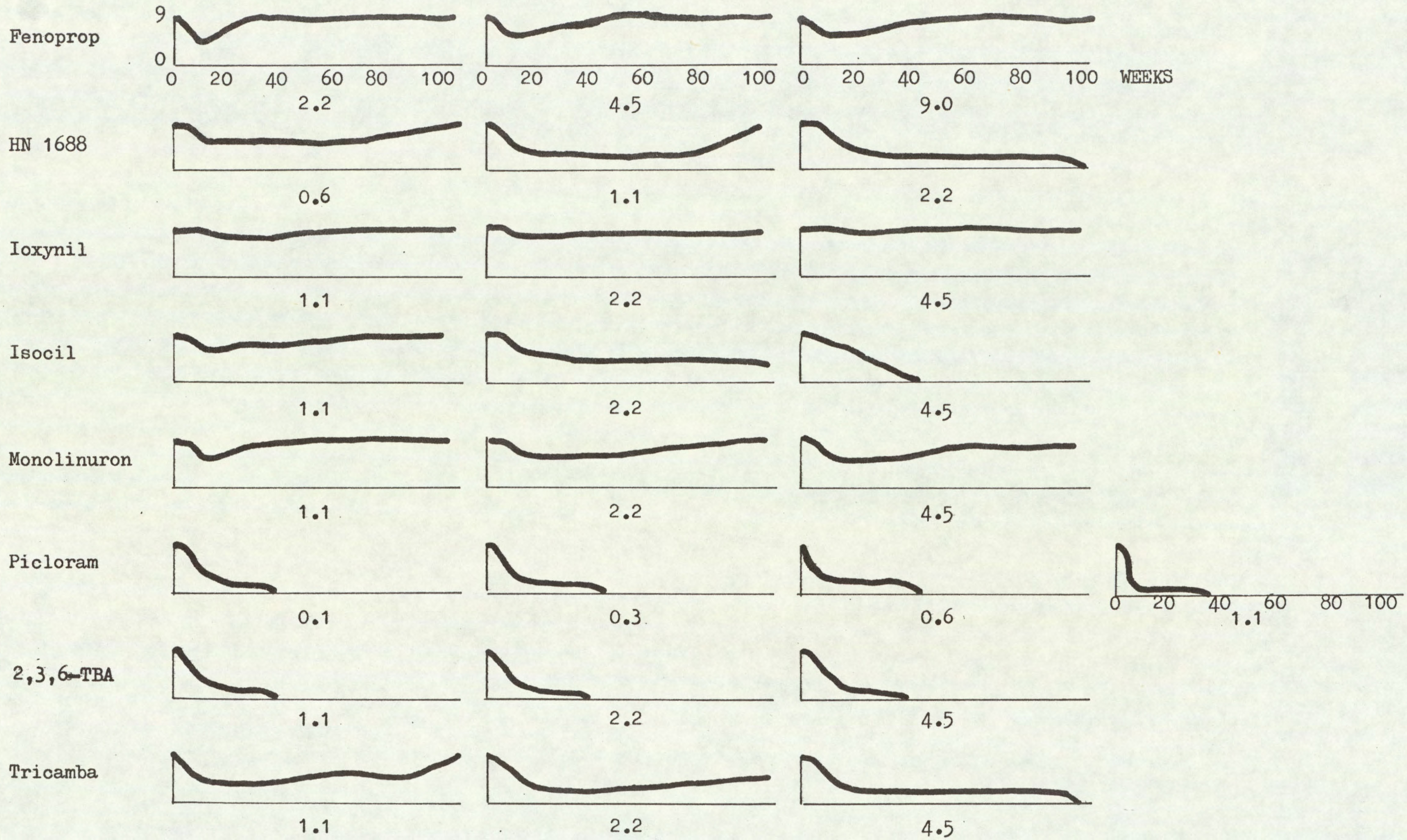


Fig. 4

The Effect of Various Herbicide Treatments Applied on 13.5.64 (Expt. 2)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

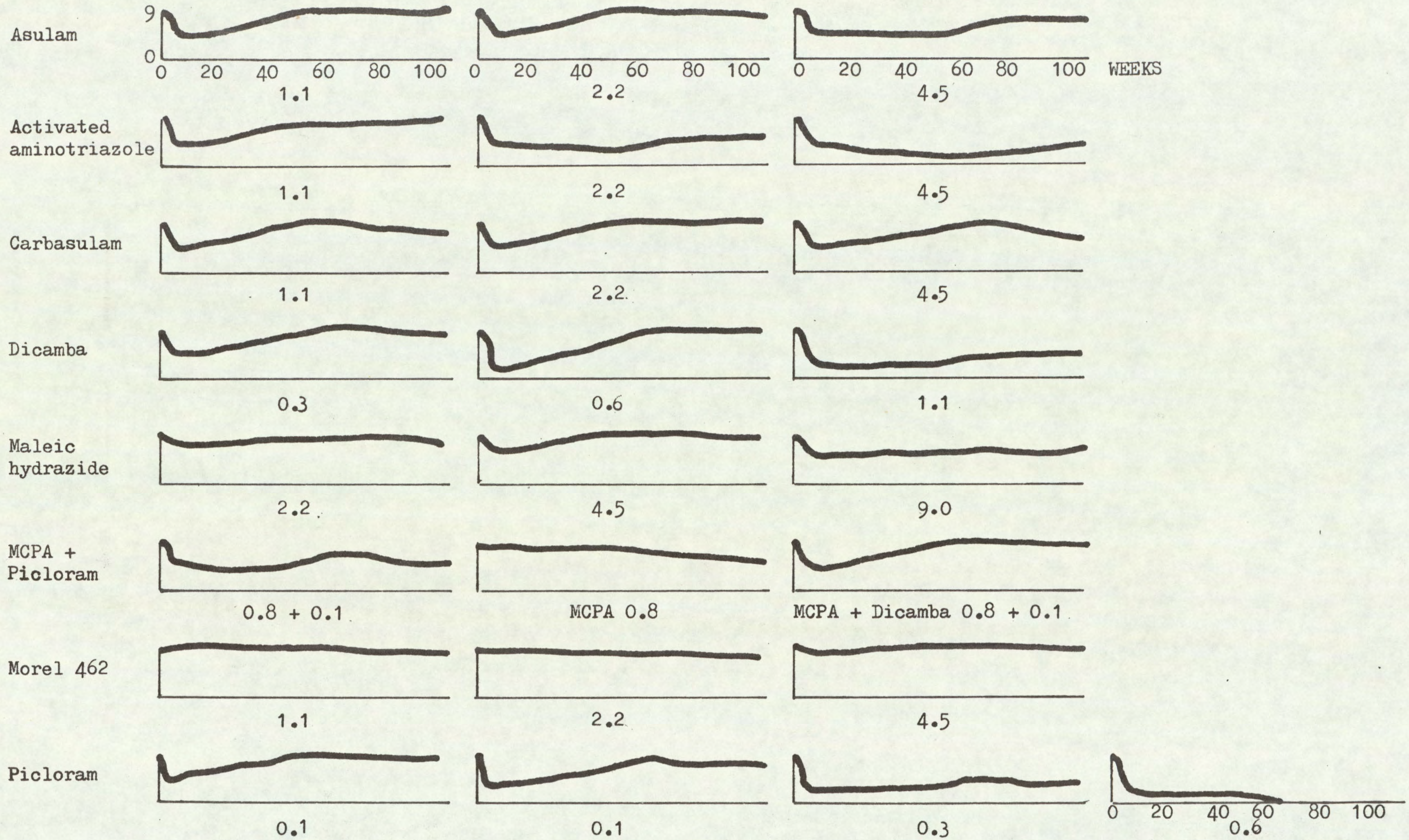


Fig. 5

The Effect of Various Herbicide Treatments Applied on 24.9.64 (Expt. 3)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

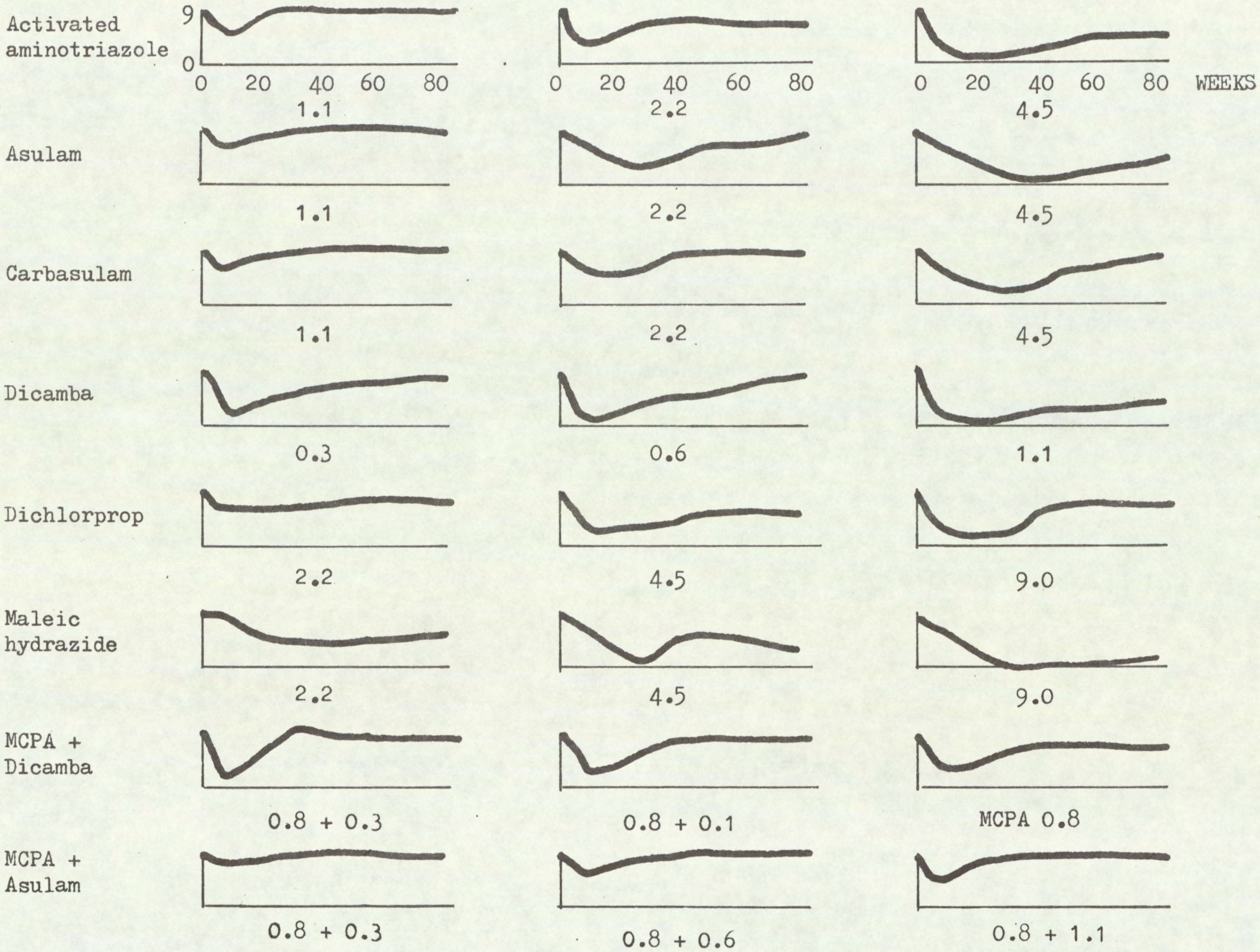


Fig. 6

The Effect of Various Herbicide Treatments Applied on 24.9.64 (Expt. 3)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

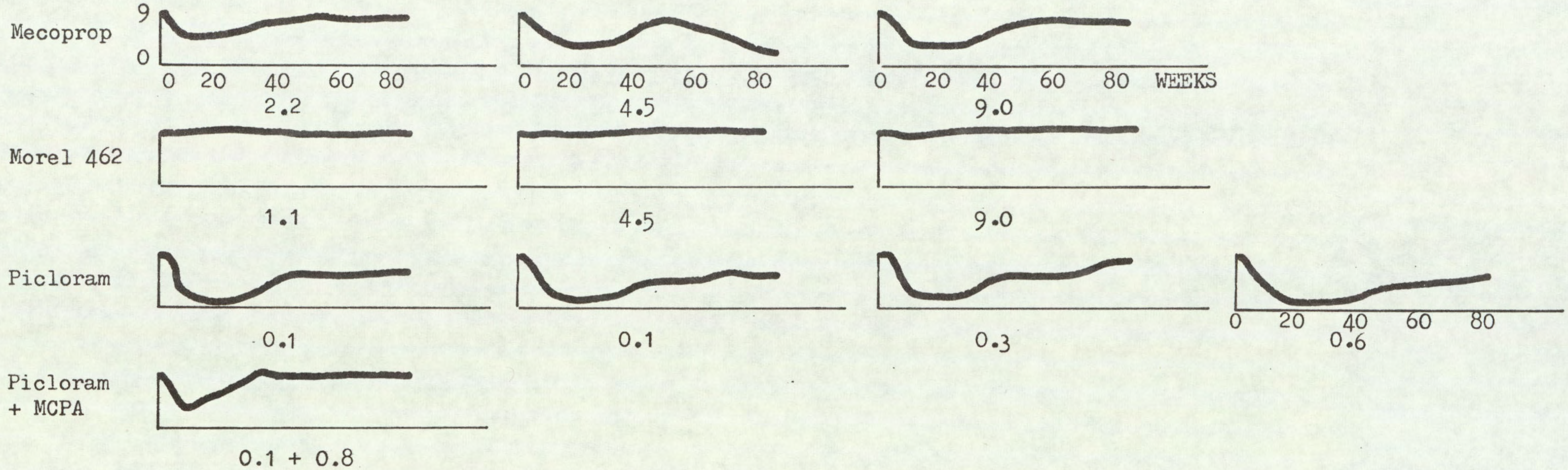


Fig. 7

The Effect of Various Herbicide Treatments Applied on 13.5.65 (Expt. 4)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg a.i./ha)

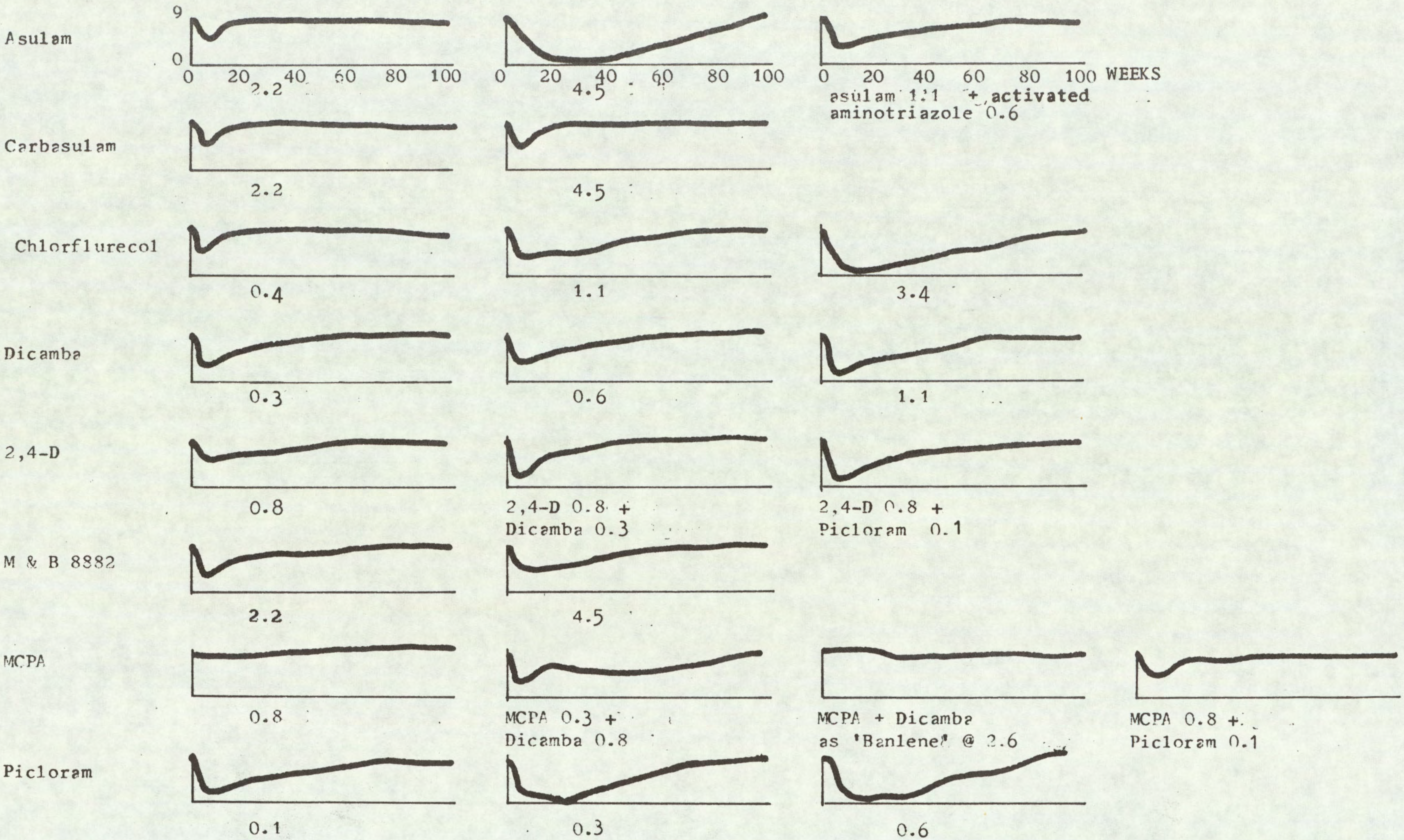


Fig. 8

The Effect of Various Herbicide Treatments Applied on 2.9.66 (Expt. 5)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg a.i./ha)

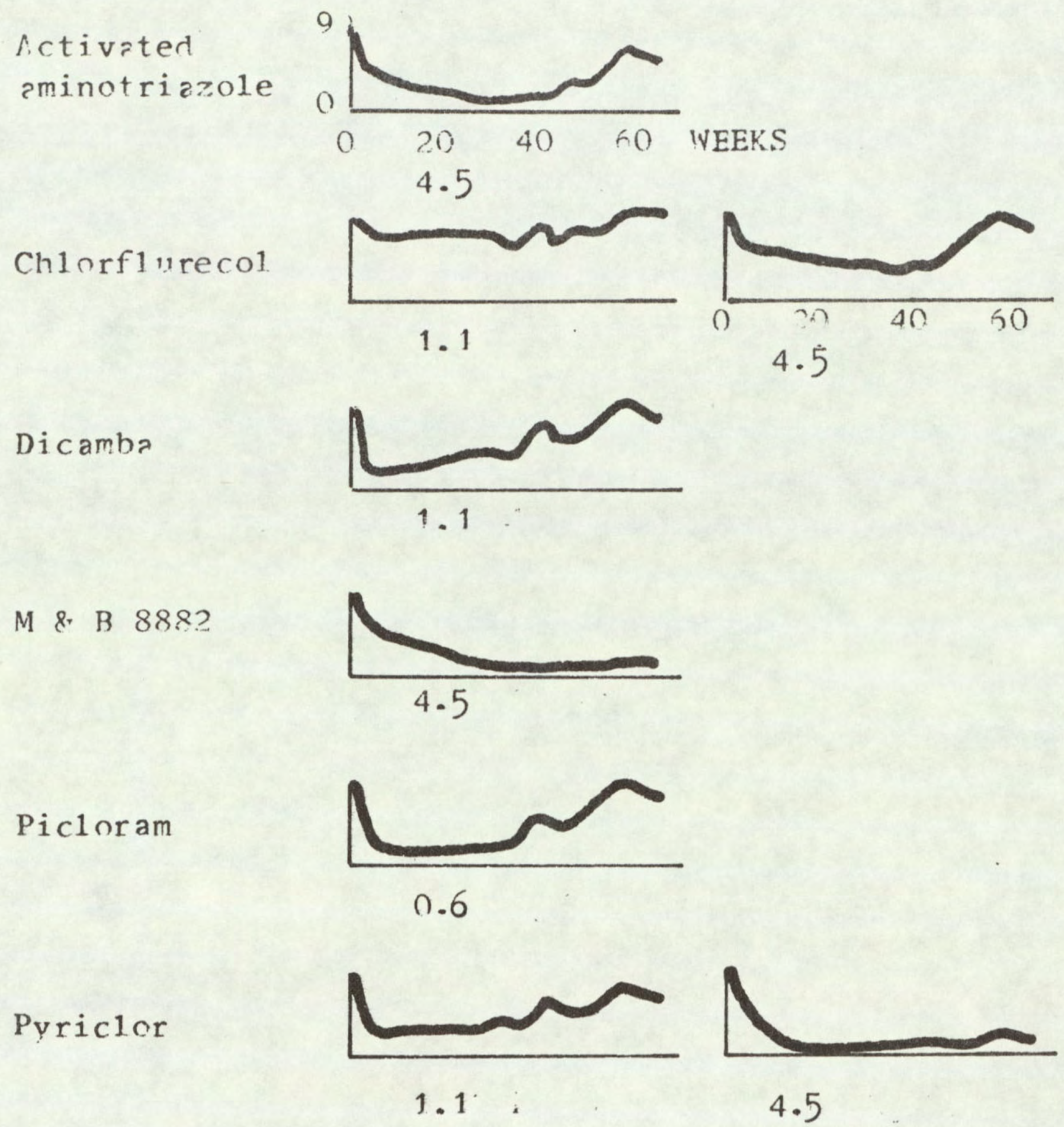


Fig. 9

The Effect of Various Herbicide Treatments Applied on 11.11.66 (Expt. 6)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

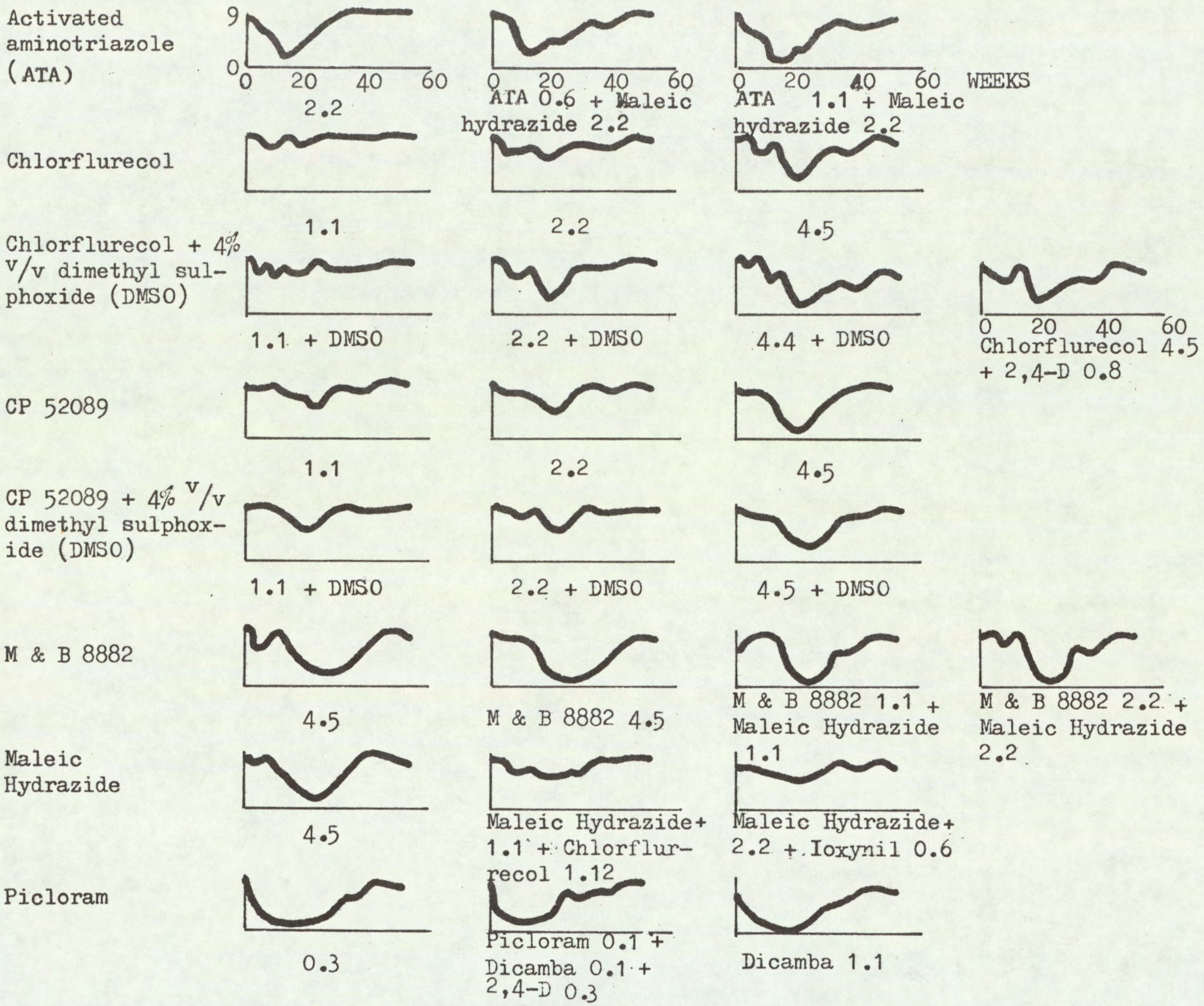


Fig. 9

The Effect of Various Herbicide Treatments Applied on 11.11.66 (Expt. 6)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

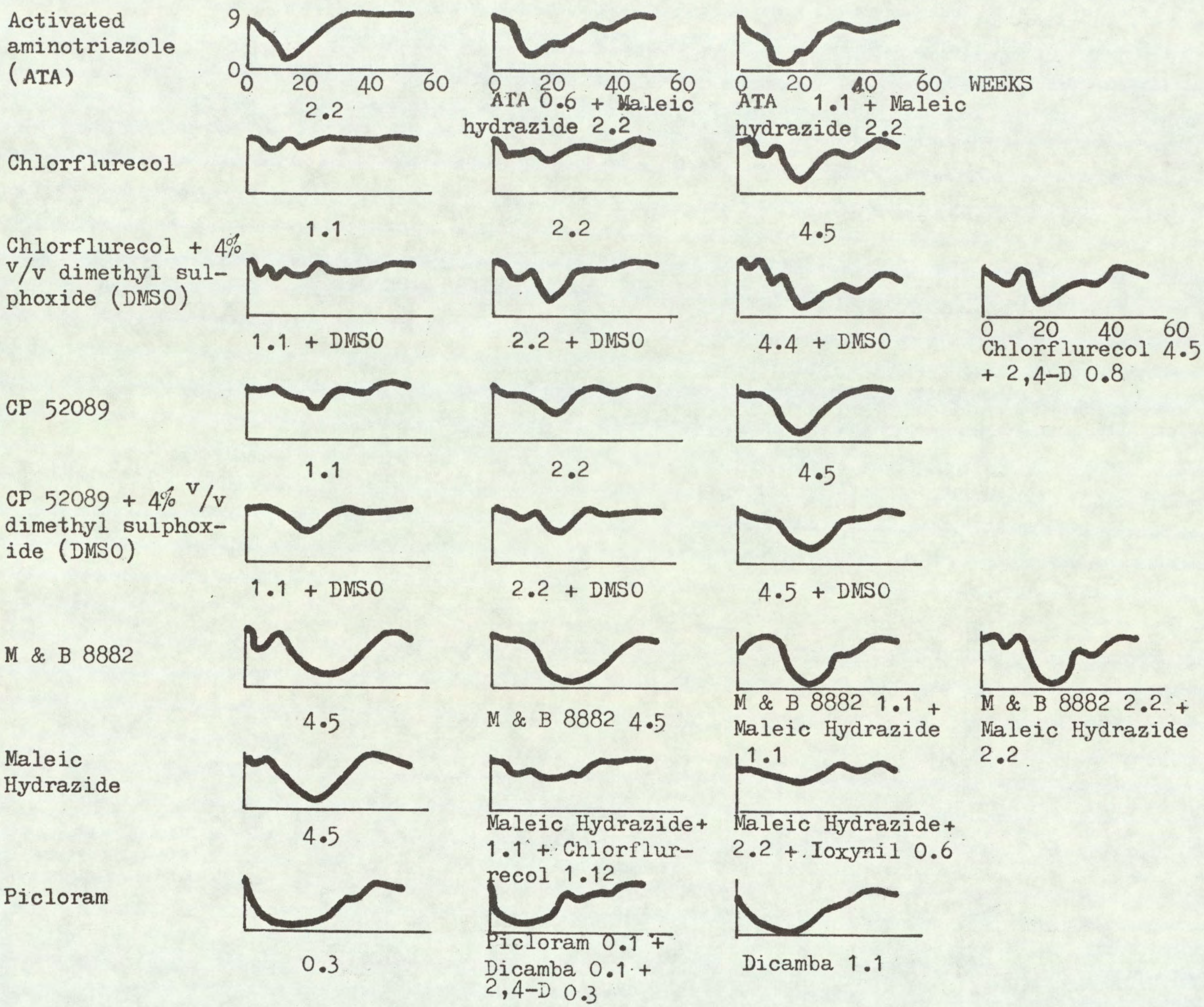


Fig. 10

The Effect of Various Herbicide Treatments Applied on 15.3.67 (Expt. 7)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

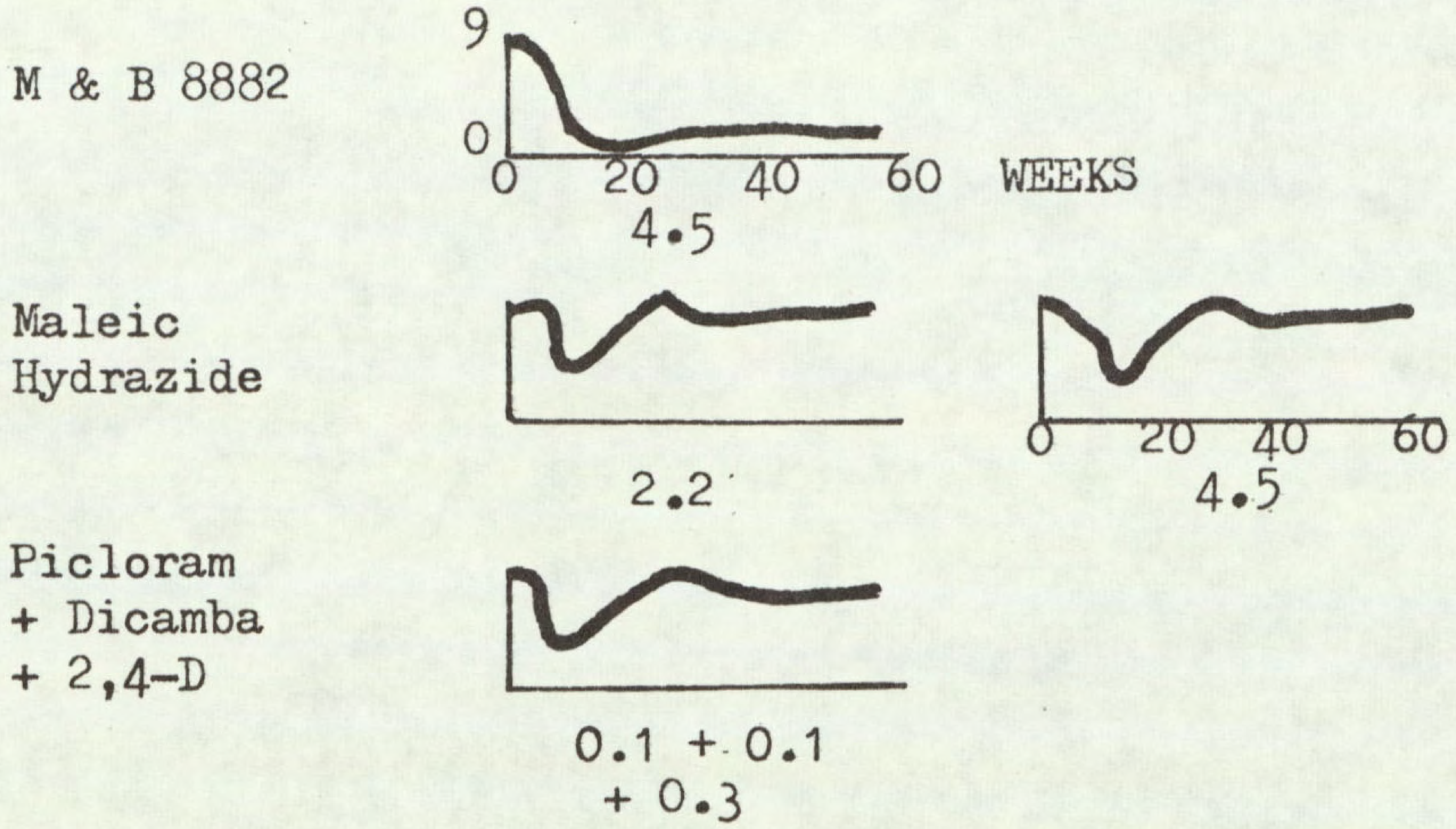


Fig. 11

The Effect of Various Herbicide Treatments Applied on 2.6.67 (Expt. 8)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

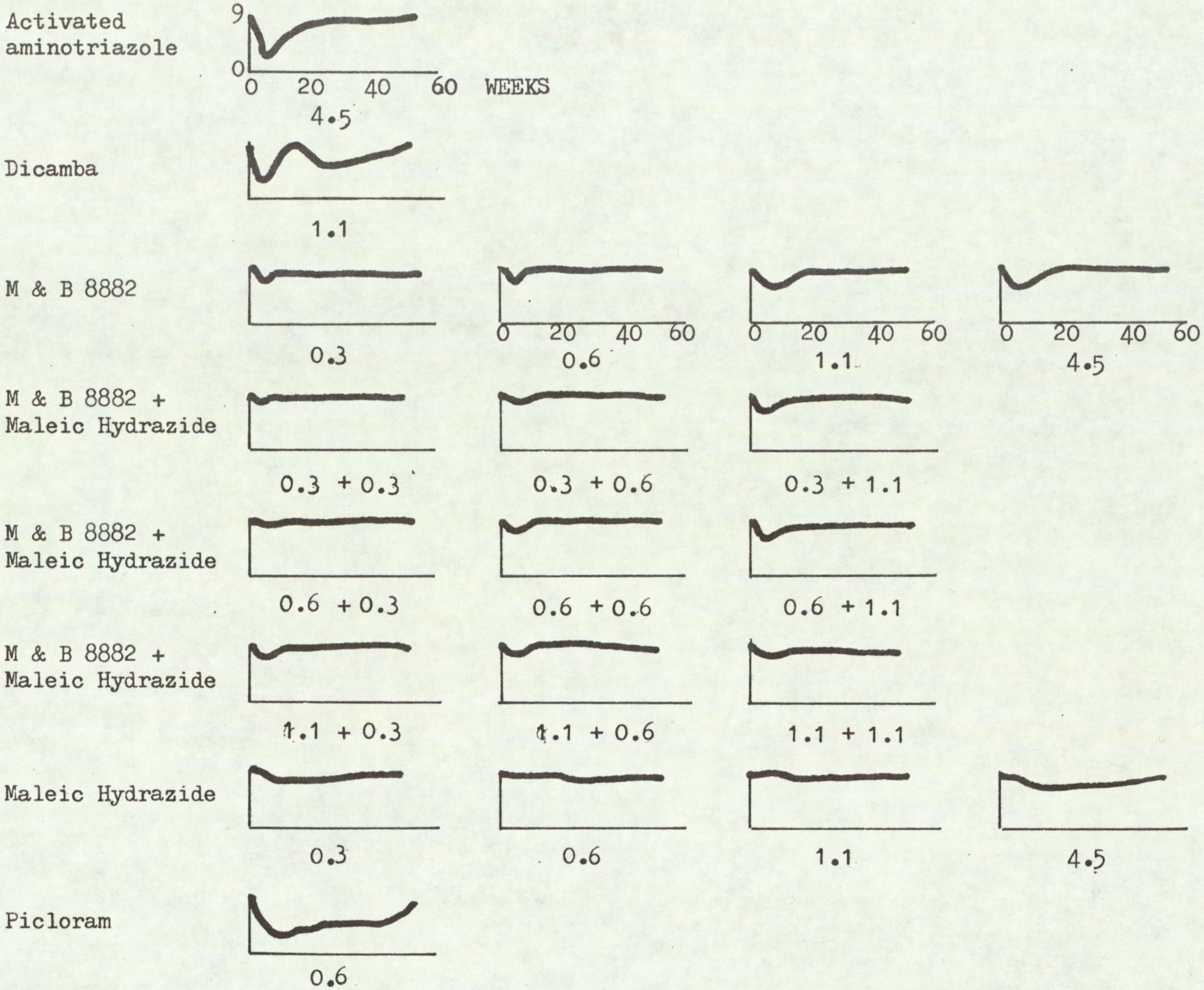


Fig. 12

The Effect of Various Herbicide Treatments Applied on 3.10.67 (Expt. 9)
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)

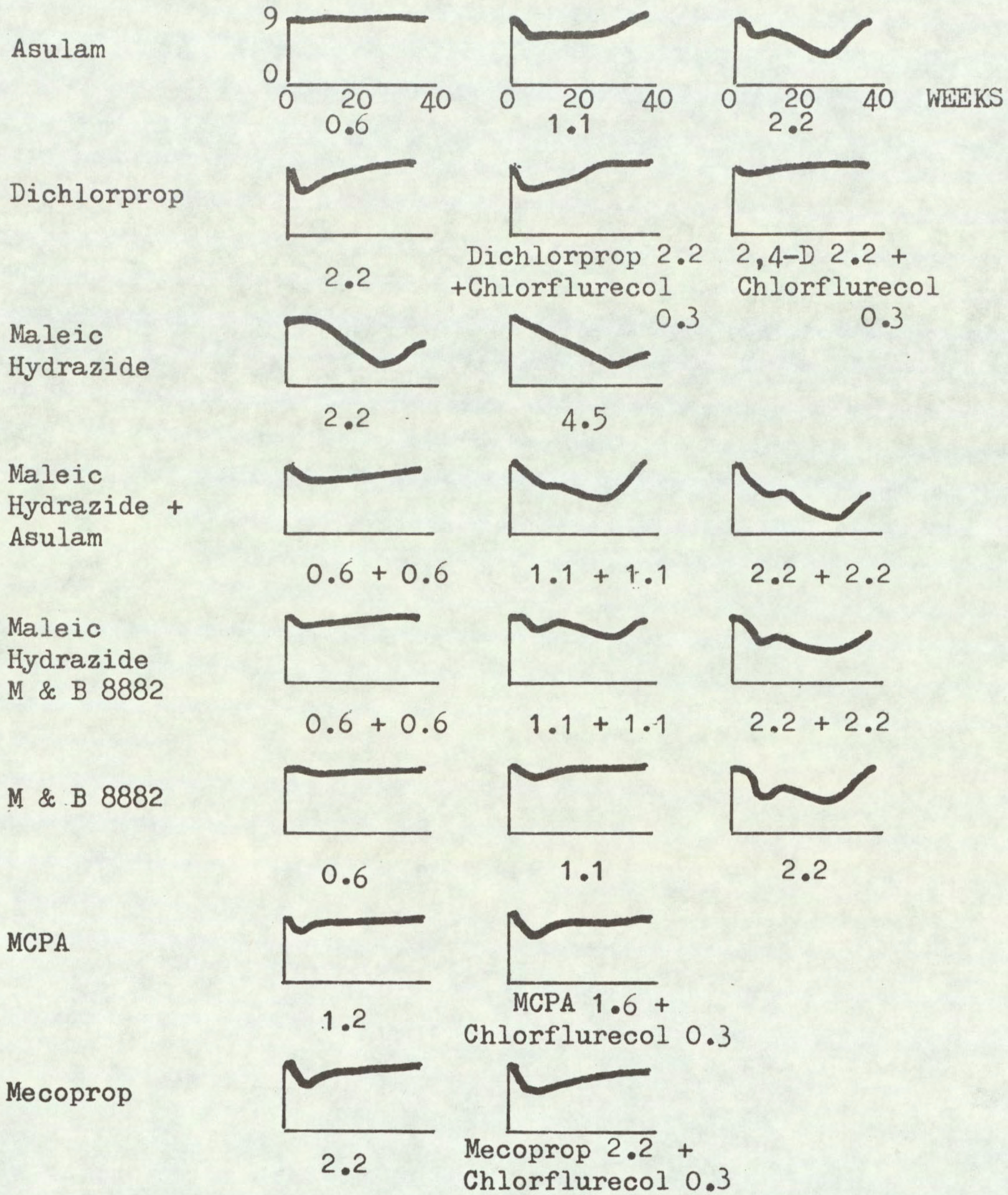


Fig. 13

The Effect of Activated Aminotriazole Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha

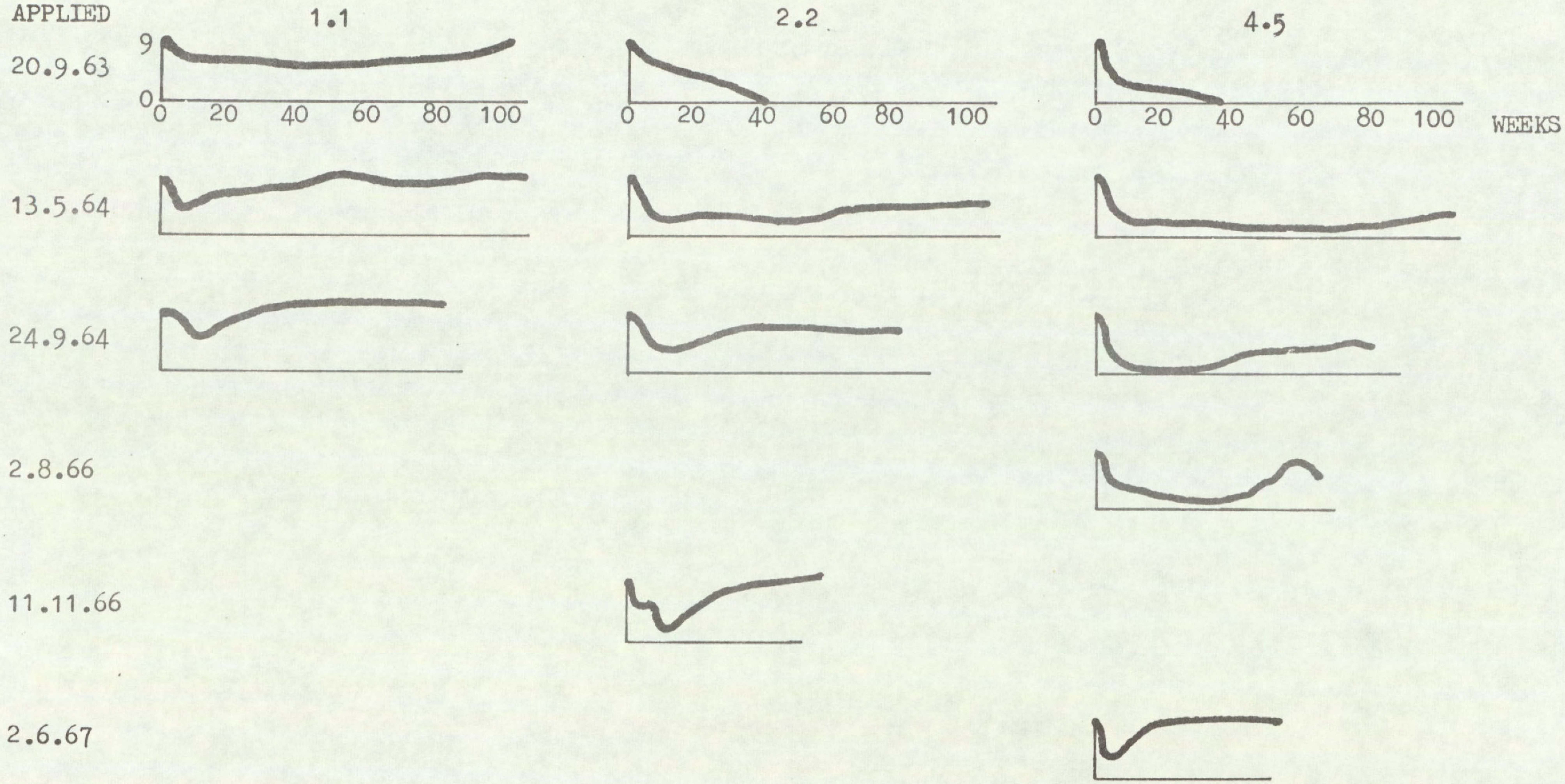
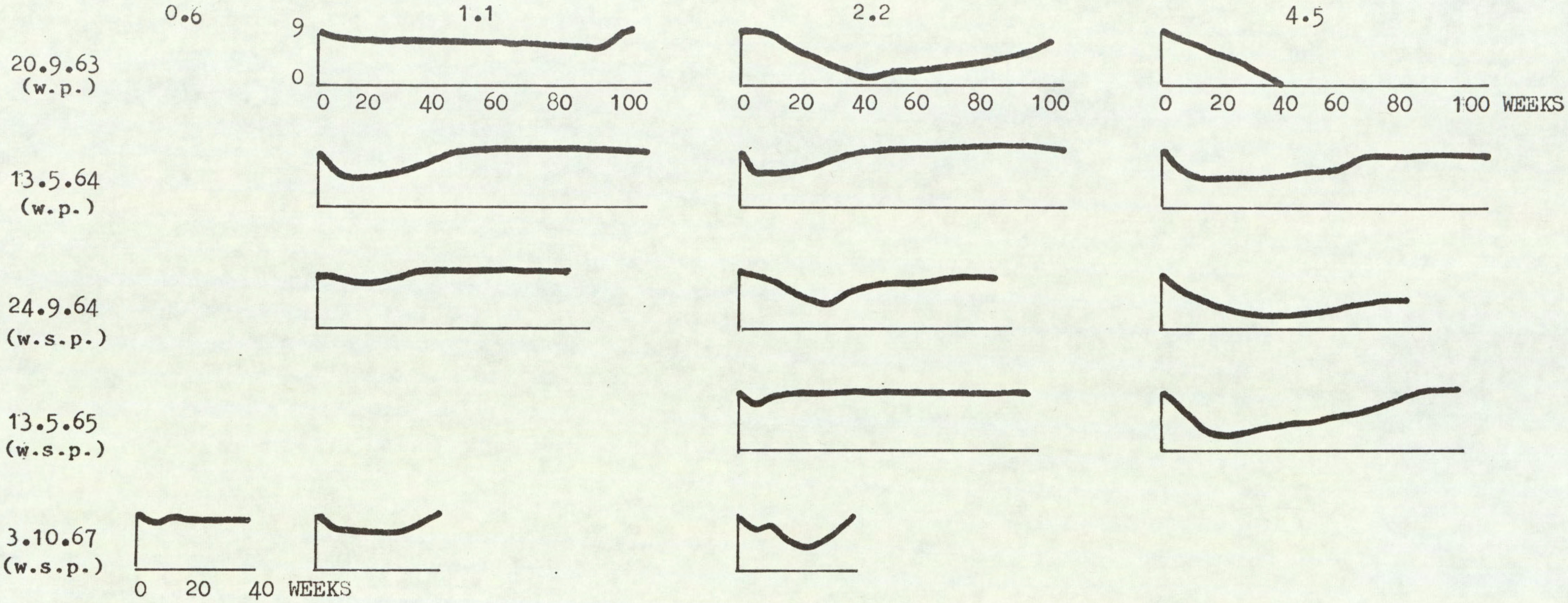


Fig. 14

The Effect of Asulam Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)



w.p. ≡ wettable powder

w.s.p. ≡ water soluble powder

Fig. 15

The Effect of Dicamba Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control; all doses in kg ai/ha)

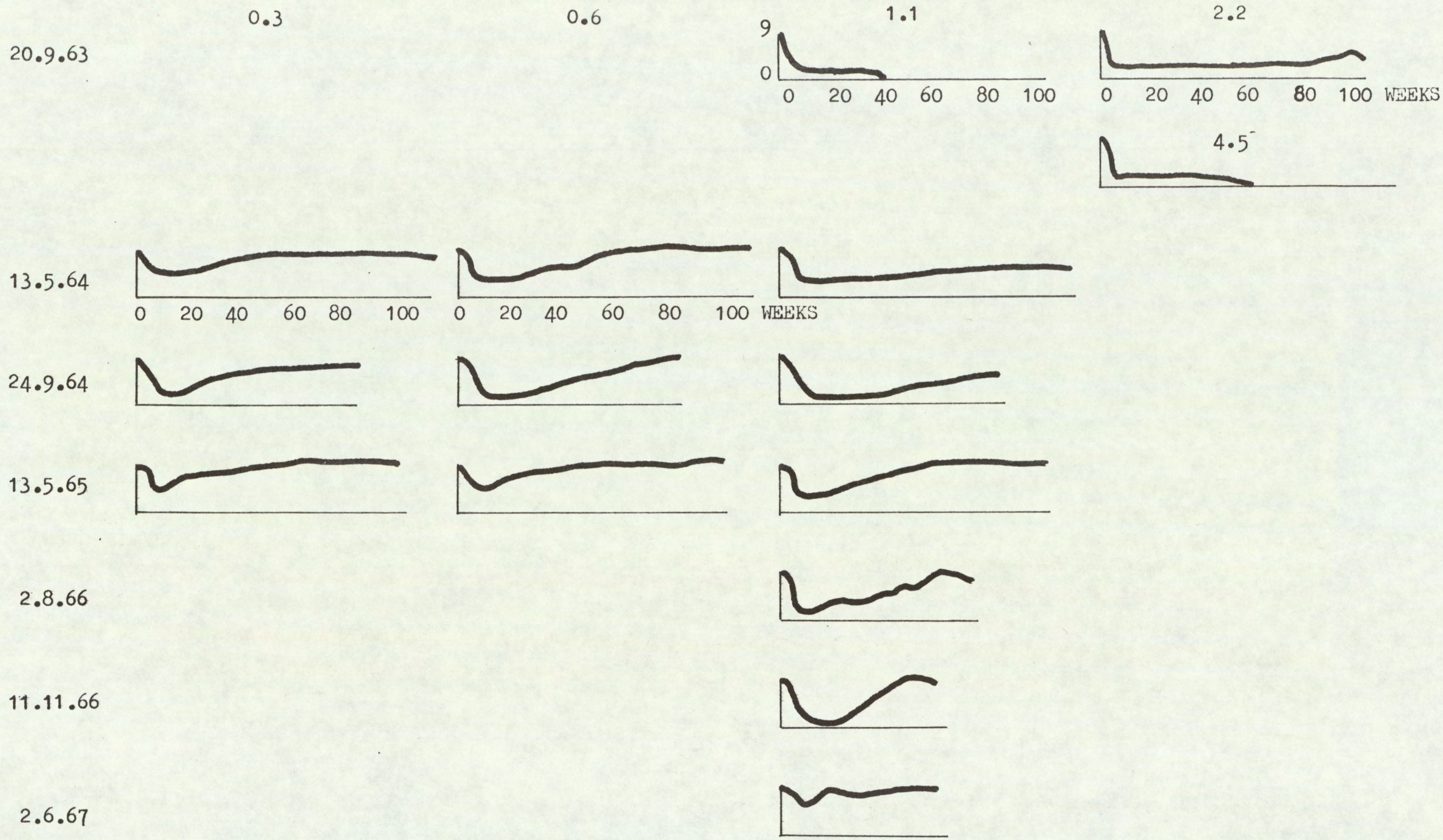


Fig. 16

The Effect of Maleic Hydrazide Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control; all doses in kg ai/ha)

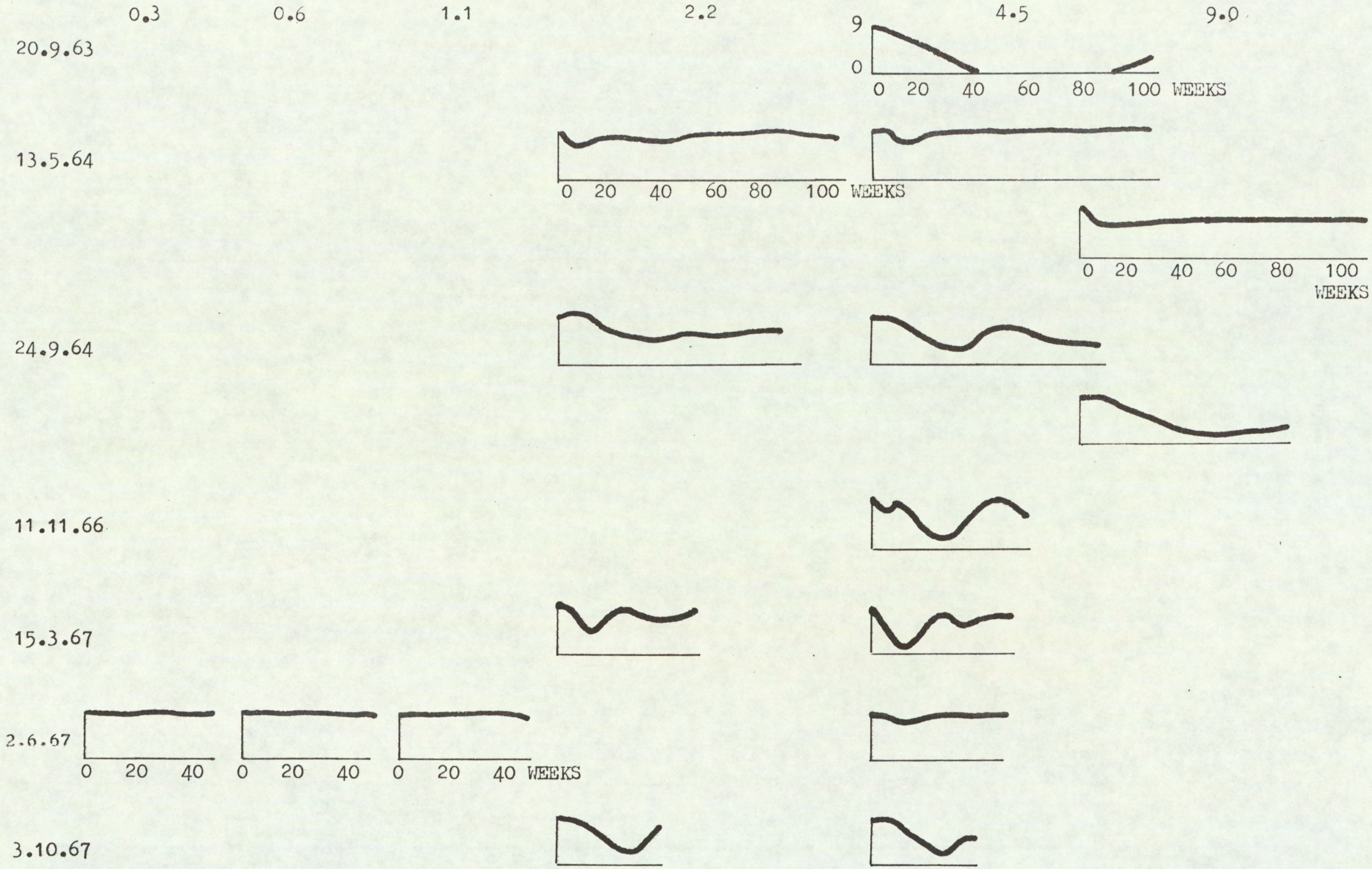


Fig. 17

The Effect of M & B 8882 Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control; all doses in kg ai/ha)

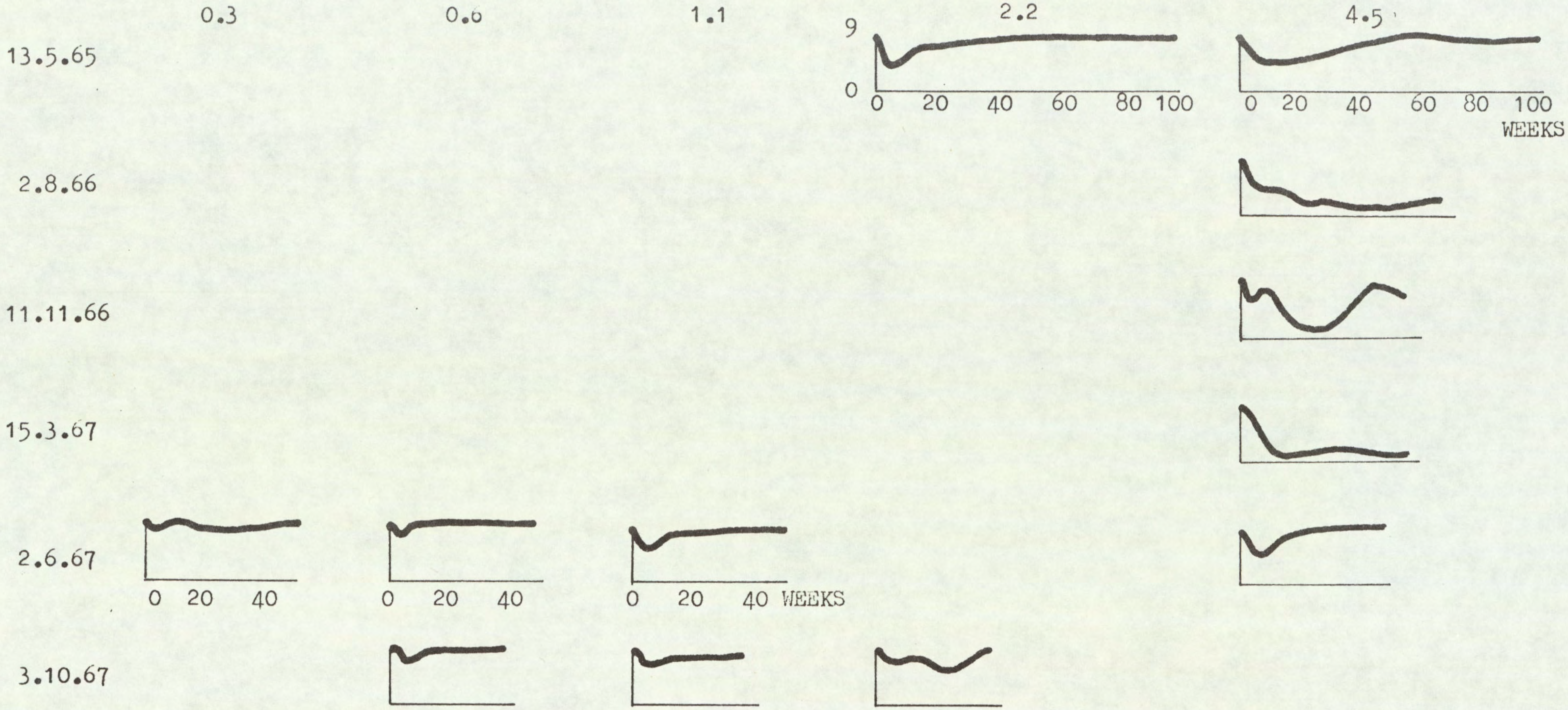
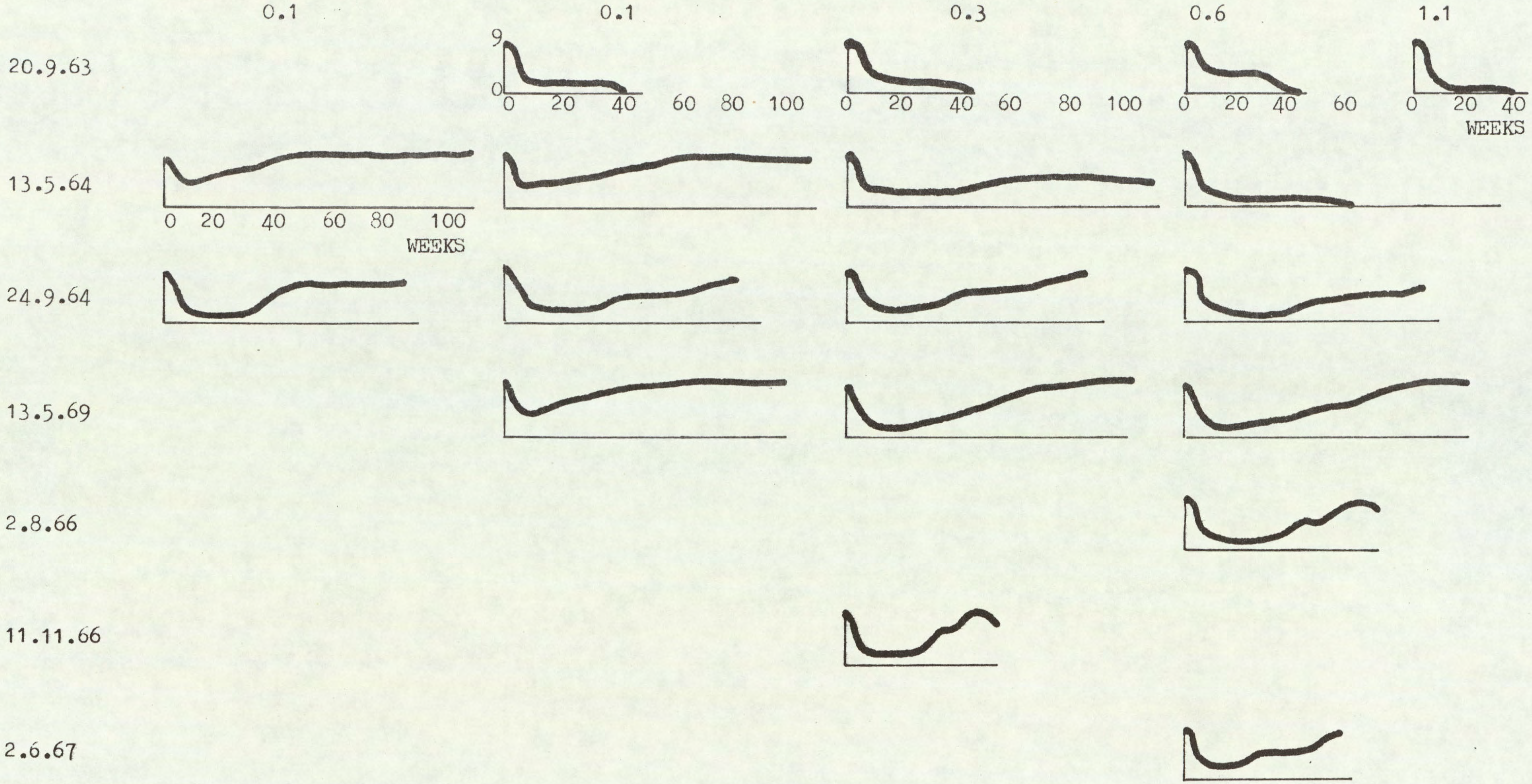


Fig. 18

The Effect of Picloram Applied at Various Dates
(Score 0 = no visible top growth, score 9 = as untreated control: all doses in kg ai/ha)



ABBREVIATIONS

ångström	Å
Abstract	Abs.
acid equivalent*	a.e.
acre	ac
active ingredient*	a.i.
approximately equal to*	$\simeq$
aqueous concentrate	a.c.
bibliography	bibl.
boiling point	b.p.
bushel	bu
centigrade	C
centimetre*	cm
concentrated	concd
concentration	concn
concentration × time product	ct
concentration required to kill 50% test animals	LC50
cubic centimetre*	cm^3
cubic foot*	ft^3
cubic inch*	in^3
cubic metre*	m^3
cubic yard*	yd^3
cultivar(s)	cv.
curie*	Ci
degree Celsius*	^{o}C
degree centigrade*	^{o}C
degree Fahrenheit*	^{o}F
diameter	diam.
diameter at breast height	d.b.h.
divided by*	÷ or /
dry matter	d.m.
emulsifiable concentrate	e.c.
equal to*	=
fluid	fl.
foot	ft
freezing point	f.p.
from summary	F.s.
gallon	gal
gallons per hour	gal/h
gallons per acre	gal/ac
gas liquid chromatography	GLC
gramme	g
hectare	ha
hectokilogram	hkg
high volume	HV
horse power	hp
hour	h
hundredweight*	cwt
hydrogen ion concentration*	pH
inch	in.
infra red	i.r.
kilogramme	kg
kilo ($\times 10^3$)	k
less than	$<$
litre	l.
low volume	LV
maximum	max.
median lethal dose	LD50
medium volume	MV
melting point	m.p.
metre	m
micro ($\times 10^{-6}$)	µ
microgramme*	µg
micromicro (pico: $\times 10^{-12}$)*	µµ
micrometre (micron)*	µm (or µ)
micron (micrometre)*[×]	µm (or µ)
miles per hour*	mile/h
milli ($\times 10^{-3}$)	m
milliequivalent*	m.equiv.
milligramme*	mg
millilitre	ml

× The name micrometre is preferred to micron and µm is preferred to µ.

millimetre*	mm
millimicro* (nano: $\times 10^{-9}$)	n or $m\mu$
minimum	min.
minus	-
minute	min
molar concentration*	M (small cap)
molecule, molecular	mol.
more than	>
multiplied by*	$\times$
normal concentration*	N (small cap)
not dated	n.d.
oil miscible concentrate	o.m.c. (tables only)
organic matter	o.m.
ounce	oz
ounces per gallon	oz/gal
page	p.
pages	pp.
parts per million*	ppm
parts per million by volume*	ppmv
parts per million by weight*	ppmw
percent(age)*	%
pico (micromicro: $\times 10^{-12}$)	p or $\mu\mu$
pint	pint
pints per acre	pints/ac
plus or minus*	$\pm$
post-emergence	post-em.
pound	lb
pound per acre*	lb/ac
pounds per minute	lb/min
pound per square inch*	lb/in^2
powder for dry application	p. (tables only)
power take off	p.t.o.
precipitate (noun)	ppt.
pre-emergence	pre-em.
quart	quart
relative humidity	r.h.
revolution per minute*	rev/min
second	s
soluble concentrate	s.c.
soluble powder	s.p.
solution	soln
species (singular)	sp.
species (plural)	spp.
specific gravity	sp. gr.
square foot*	ft^2
square inch*	in^2
square metre*	m^2
square root of*	$\sqrt{\ }$
sub-species*	ssp.
summary	s.
temperature	temp.
ton	ton
tonne	t
ultra-low volume	ULV
ultra violet	u.v.
vapour density	v.d.
vapour pressure	v.p.
<u>varietas</u>	var.
volt	V
volume	vol.
volume per volume	v/v
water soluble powder	w.s.p. (tables only)
watt	W
weight	wt
weight per volume*	w/v
weight per weight*	w/w
wettable powder	w.p.
yard	yd
yards per minute	yd/min

* Those marked * should normally be used in the text as well as in tables, etc.

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Technical reports available

5. A survey of the problem of aquatic weed control in England and Wales. October, 1967. T.O. Robson. Price - £0.25.

6. The botany, ecology, agronomy and control of Poa trivialis L. rough-stalked meadow-grass. November 1966. G.P. Allen. Price - £0.25.

7. Flame cultivation experiments 1965. October, 1966. G.W. Ivens. Price - £0.25.

8. The development of selective herbicides for kale in the United Kingdom. 2. The methylthiotriazines. Price - £0.25.

9. The post-emergence selectivity of some newly developed herbicides (NC 6627, NC 4780, NC 4762, BH 584, BH 1455). December, 1967. K. Holly and Mrs. A.K. Wilson. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.50.

10. The liverwort, Marchantia polymorpha L. as a weed problem in horticulture; its extent and control. July, 1968. I.E. Henson. Price - £0.25.

11. Raising plants for herbicide evaluation; a comparison of compost types. July, 1968. I.E. Henson. Price - £0.25.

12. Studies on the regeneration of perennial weeds in the glasshouse; I. Temperate species. May, 1969. I.E. Henson. Price - £0.25.

13. Changes in the germination capacity of three Polygonum species following low temperature moist storage. June, 1969. I.E. Henson. Price - £0.25.

14. Studies on the regeneration of perennial weeds in the glasshouse. II. Tropical species. May, 1970. I.E. Henson. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.50.

15. Methods of analysis for herbicide residues in use at the Weed Research Organization. December, 1970. R.J. Hance and C.E. McKone. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.50.

16. Report on a joint survey of the presence of wild oat seeds in cereal seed drills in the United Kingdom during Spring 1970. November, 1970. J.G. Elliott and P.J. Attwood. Price - £0.25.

17. The pre-emergence selectivity of some newly developed herbicides, Orga 3045 (in comparison with dalapon), haloxydine (PP 493), HZ 52.112, pronamide (RH 315) and R 12001. January, 1971. W.G. Richardson, C. Parker and K. Holly. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.50.

18. A survey from the roadside of the state of post-harvest operations in Oxfordshire in 1971. November, 1971. A. Phillipson. Price - U.K. and overseas surface mail - £0.12; overseas airmail - £0.34.

19. The pre-emergence selectivity of some recently developed herbicides in jute, kenaf and sesamum, and their activity against Oxalis latifolia. December, 1971. M.L. Dean and C. Parker. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.45.

20. A survey of cereal husbandry and weed control in three regions of England. July, 1972. A. Phillipson, T.W. Cox and J.G. Elliott. Price - U.K. and overseas surface mail - £0.35; overseas airmail - £0.75.

21. An automatic punching counter. November, 1972. R.C. Simmons. Price - U.K. and overseas surface mail - £0.30; overseas airmail - £0.50.

22. The pre-emergence selectivity of some newly developed herbicides: bentazon, BAS 3730H, metflurazone, SAN 9789, HER 52.123, U 27,267. December 1972. W.G. Richardson and M.L. Dean. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.45.

23. A survey of the presence of wild oats and blackgrass in parts of the United Kingdom during summer 1972. A. Phillipson. Price - U.K. and overseas surface mail - £0.25; overseas airmail - £0.45.

24. The conduct of field experiments at the Weed Research Organization. February 1973. J. G. Elliott, J. Holroyd and T. O. Robson. Price U.K. and overseas surface mail - £1.25; overseas airmail - £1.47.

25. The pre-emergence selectivity of some recently developed herbicides: lenacil, RU 12068, metribuzin, cyprazine, EMD-IT 5914 and benthiocarb. August 1973. W.G. Richardson and M.L. Dean. Price - U.K. and overseas surface mail - £1.75; overseas airmail - £2.20.

26. The post-emergence selectivity of some recently developed herbicides: bentazon, EMD-IT 6412, cyprazine, metribuzin, chlornitrofen, glyphosate, MC 4379, chlorfenprop-methyl. October 1973. W.G. Richardson and M.L. Dean. Price - U.K. and overseas surface mail - £3.31; overseas airmail - £3.56.

27. Selectivity of benzene sulphonyl carbamate herbicides between various pasture grasses and clover. October 1973. A.M. Blair. Price - U.K. and overseas surface mail - £1.05; overseas airmail - £1.30.

28. The post-emergence selectivity of eight herbicides between pasture grasses: RP 17623, HOE 701, BAS 3790, metoxuron, RU 12068, cyprazine, MC 4379, metribuzin. October 1973. A.M. Blair. Price - U.K. and overseas surface mail - £1.00; overseas airmail - £1.25.

29. The pre-emergence selectivity between pasture grasses of twelve herbicides: haloxydine, pronamide, NC 8438, Orga 3045, chlortoluron, metoxuron, dicamba, isopropalin, carbetamide, MC 4379, MBR 8251 and EMD-IT 5914. November 1973. A.M. Blair. Price - U.K. and overseas surface mail - £1.30; overseas airmail - £1.50.

30. Herbicides for the control of the broad-leaved dock (Rumex obtusifolius L.). November 1973. A.M. Blair and J. Holroyd. Price - U.K. and overseas surface mail - £1.06; overseas airmail - £1.30.