SOME EFFECTS OF COMMON HERBICIDES ON WHEAT CULTIVARS

W.J.P. MITCHEL and A.I. POPAY

*Crop Research Division, DSIR and Soils and Field Research
Organisation, MAF, Palmerston North*

Summary

Six wheat cultivars were sprayed with four herbicides at normal and twice normal rates. Height, visible damage to the head, and grain yield were measured. Some herbicides had more serious effects than others, with 2,4-D amine at double rate having the most deleterious effect over all parameters measured. Some wheat cultivars were less tolerant than others to different herbicides.

INTRODUCTION

In a cereal breeding programme, the selection of early generation material is based on visual assessment of such characters as head type, tightness of chaff, yield potential, and resistance to lodging, shattering and diseases. Efficient weed control is necessary, but chemicals used for weed control must not adversely affect the appearance of the head. If the herbicides altered the appearance of some crosses or selections from these crosses, the crosses might be rejected early in the breeding programme purely because of herbicide effects. In Cambridge, England, where wheat breeding material was sprayed with substituted urea herbicides at three times normal rate, genetical variation in susceptibility to damage was found within crosses (Lupton *et al* 1974). Varietal differences in the effects of applied dicamba and barban were also confirmed. Mixtures of MCPA and dicamba, and MCPA and bromoxynil are used to control weeds in cereal crops (Isaacs and Miles 1966; Anon 1974). Barban is commonly used to control wild oats (*Avena fatua*) in Canterbury (Allen 1962).

Six cultivars of wheat were tested against locally recommended herbicides at the recommended rate and at double this rate.

METHODS

Replicated plots of six wheat cultivars, namely 'Karamu/9', 'Gamenya', '61,01' and 'Rongotea' (both selections from the cross 'Raven' x '66RN430'), 'Oroua' (a selection from the cross 'Skemer' x '66RN395') and 'Pataka/2' (a selection from a Minnesota line), were sown in small three-row plots. At the four leaf stage MCPA/dicamba, MCPA/bromoxynil, 2,4-D amine and barban were applied at the recommended rate and twice the recommended rate in 238 litres/ha. The trial was a split plot design with four replications. Herbicides were main plots and cultivars were sub-plots. All plots were regularly hand weeded to prevent weed competition. Maturity was recorded as days from sowing to 50% ear emergence. Plant heights

Proc. 30th N.Z. Weed and Pest Control Conf.

Crop Weeds

were recorded before harvest in five positions in each plot. Visual damage to the mature heads was assessed on a 1-5 scale (1 = no damage, 5 = severe damage). Plots were harvested with a Hege small-plot harvester.

RESULTS

Maturity

Significant differences between cultivars were recorded, but there were no significant responses to herbicides. However, maturity was delayed with barban by 1.5 days and with 2,4-D amine by 1.25 days, at double rates only.

Visual damage

Damage scores showed highly significant differences in the damage caused by herbicides. Barban shortened the heads slightly, but was not recorded as doing any damage. Plots sprayed with MCPA/dicamba and MCPA/bromoxynil at normal rates had slightly distorted heads. Moderate distortion occurred on plots sprayed with either of these materials at the high rate or with 2,4-D amine at the normal rate. Severe distortion, i.e. mis-shapen heads with open spikelets and missing grain, occurred on nearly all plots sprayed with the high rate of 2,4-D amine. There were no interactions between herbicides and cultivars.

Height

MCPA/dicamba and 2,4-D amine at high rates and barban at normal and double rates reduced height significantly (Table 1). There were no interactions between cultivars and herbicides.

TABLE 1: Mean Responses

<i>Cultivar comparisons</i>			
Cultivar	Yield (100=6.7 t/ha)	Height (cm)	Damage score (1-5)
'Karamu/9'	100 a	72.7 f	2.0
'Gamenya'	78 d	91.2 a	1.8
'61,01'	101 a	85.4 c	2.0
'Rongotea'	98 a	83.9 d	1.9
'oroua'	95 b	80.0 e	1.8
'Pataka/2'	91 c	86.8 b	2.0
CV% (sub-plots)	7.8	3.3	16.1
<i>Herbicide comparisons</i>			
Treatment (kg/ha)			
Untreated	100 ab	85.6 a	1.0
MCPA/dicamba (0.75/0.125)	95 abc	83.5 bc	1.6
MCPA/dicamba (1.5/0.25)	95 abc	82.7 cd	2.1
MCPA/bromoxynil (0.4/0.4)	97 abc	85.4 ab	1.6
MCPA/bromoxynil (0.8/0.8)	95 bc	85.4 ab	2.1
2,4-D amine (1.0)	97 abc	85.2 ab	2.1
2,4-D amine (2.0)	80 d	80.3 de	4.9
barban (0.35)	101 a	82.4 cd	1.0
barban (0.7)	91 c	79.3 e	1.0
CV% (main plots)	9.6	3.8	48.0

Crop Weeds

Yields

'Karamu/9', '61,01' and 'Rongotea' significantly outyielded 'Oroua', which outyielded 'Pataka/2'. 'Gamenya' was the lowest yielding. Although herbicides reduced yields, the only herbicides to reduce yield significantly overall were MCPA/bromoxynil, 2,4-D amine and barban at the high rate (Table 1). Interactions between cultivars and herbicides just reached significance at the 1% level (Table 2). Yields of all cultivars were significantly lowered by the high rate of 2,4-D amine. In addition, MCPA/dicamba at the high rate reduced the yield of 'Gamenya' and 'Pataka/2'. MCPA/bromoxynil at the high rate reduced the yield of 'Gamenya' only, while barban at the high rate reduced the yield of '61,01', 'Rongotea' and 'Pataka/2'. No serious reductions in yield were shown for any cultivars by normal rates of any chemical.

TABLE 2: Cultivar x herbicide interactions

Yield relative to untreated yield = 100										
Treatment (kg/ha)	'Karamu/9'	'Gamenya'	'61,01'	'Rongotea'	'Oroua'	'Pataka/2'				
untreated	100	100	100	100	100	100				
MCPA/dicamba (0.75/0.125)	97	90	98	91	95	91				
MCPA/dicamba (1.5/0.25)	102	82	97	102	99	85				
MCPA/bromoxynil (0.4/0.4)	96	90	100	98	101	93				
MCPA/bromoxynil (0.8/0.8)	94	85	97	98	102	91				
2,4-D amine (1.0)	97	92	100	110	96	93				
2,4-D amine (2.0)	75	73	81	87	90	73				
barban (0.35)	99	100	100	101	104	100				
barban (0.7)	101	94	86	85	95	88				
LSD 5%	9	11	9	10	10	10				

Crop Weeds

DISCUSSION AND CONCLUSION

At normal rates none of the commercially used herbicides tested had any serious effects on height, head appearance and yield of a range of cultivars. Provided that recommended chemical rates were not exceeded, there would be little likelihood of any of these cultivars being rejected as a result of herbicide damage. If higher-than-normal rates of some chemicals were applied some wheat cultivars might suffer significant yield loss.

ACKNOWLEDGEMENTS

The authors wish to thank the staff of the Crop Research Division (DSIR) substation, Palmerston North for advice and assistance; also D. Wright, Biometrician, MAF, Palmerston North for statistical interpretation.

REFERENCES

- Allen, F.C., 1962. Wild oats. *Proc. 15th N.Z. Weed and Pest Control Conf.*: 109.
- Anon, 1974. I.W.D. Technical Report No. 204.
- Isaacs, D.C. and Miles, K.B., 1966. Control of weeds in cereals with ioxynil/mecoprop, bromoxynil and bromoxynil/MCPA. *Proc. 19th N.Z. Weed and Pest Control Conf.*: 28-37
- Lupton, F.G.H., Bingham, J., Oliver, R.H., Wilson, F.E., Jackson, P.J. and Blackman, J.A., 1974. P.B.I., Cambridge Annual Report, 76.