CYTOCHEMICAL AND GROWTH EFFECTS OF HERBICIDES USED ON SOME ECONOMIC PLANTS

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Introduction

Weeds compete with crops for nutrient, water, space and light. The roots of some weeds even secrete toxic substances into the soil which affect the growth of plants adversely. Moreover, weeds harbour insects, diseases and other pests. Therefore, weed control is a major factor to get a high yield of profitable crops.

In recent years, labourers for handweeding are becoming increasingly scarce and costly. Agriculture technology is undergoing a new revolution, the mechanical revolution has completely altered agricultural methods. In spite of this mechanical revolution, there is a number of drawbacks, such as injuries to roots and soil compaction. Nowadays, the chemical revolution is carrying on to new heights of efficiency. Chemical weed control is a miracle of our technological age. Long known as one of the most arduous of agricultural operations, weed killing has taken an entirely new aspect as chemical compounds are added to our arsenal of herbicides. With new and better compounds being synthesized and developed almost each day, it seems that improvements will continue for the foreseeable future. (Ashton and Craft, 1973).

Chemical weed control is a relatively new science that involves knowledge in the fields of chemistry and biology,

some familiarity with reactions of plants to phytotoxic agents and at least observational experience in the responses of common weeds and crops to herbicides. In this instant, the increment in using such chemicals has facused the attention on the fact that they may alter the genetic background of both crops and weeds similar to those produced by radiation and radiomimic substances. That is why extensive work has been done to elucidate the effect of such different chemicals on mitosis. Also studies extended to include the effects of herbicides on chromosome behaviour in meiosis in order to evaluate the mode of action of herbicides on the genetic material.

The present study has been carried out to provide further informations about the action of selective group of herbicides on morphological, cytological and chemical components of both wheat and maize.

II. REVIEW OF LITERATURE

. MORPHOLOGICAL STUDIES:

Klingman (1953), stated that the number of spikelets per .ead of treated plots with 2,4-dichlorophenoxy acetic acid 2,4-D" and 2,4,5-trichlorophenoxy acetic acid "2,4,5-T" at lifferent stages of growth in winter wheat were not signifi-:antly different from check in 11 of 12 dates of treatment. ilso growth abnormalities occurred with treatments in early stages of growth.

Lyle et al. (1953), noticed that the butyl ester form of 2,4-D was more toxic to all varieties of oats and barley as indicated by yield reduction and production of malformation, than were the triethanol amine salt or monohydrate sodium salt. It is worthy to mention that reduction in yield was also related to the stage of spraying. Tolerance to 2,4-D salt was more in oats than in barley at certain stages. Hence, oats yields were not constantly affected but barley yields were reduced at 5-leaf and heading stages of growth.

Unrau (1953), observed variation within spikes and between barley plants after spraying with 2,4-D.

Williams (1954), stated that number of spikelets per panicle in oats were reduced to a great extent by treatment with 2,4-D at the second stage during floral primordia initiation. Whilst, kernels per spikelet were reduced mostly by

reatment 4-days later.

Woofter et al. (1954), indicated that the developmental tages of winter wheat sprayed with 2,4-D had a highly signi-icant effect on yield. The greatest yield reduction was bserved at the early heading stage of herbicide application. ignificant yield reduction also occurred at all rates of ,4-D when applied at susceptable stages but no significant eduction occurred from any rate at resistant stages. The ost resistant period was between the fully tillered and joint-ng stage.

Wiese and Rea (1958), illustrated that yield was severly educed by all rates of 2,4-D applied at the most susceptile tage "flowering stage" in sorghum because many florets failed o produce seeds. While, application of either forms of 2,4-D ster or amine salt did'nt reduce the yield except at the lowering stage.

Moreland et al. (1959), reported that barley and other mall grains were not able to tolerate pre-emergent applications f even 2 pounds per acre of "simazine".

Friesen et al. (1964), indicated that the intensity and ocal of the morphological effects of dicamba (2 methoxy-3,6-ichlorobenzoic acid) varied with the dosage and the time of pplication in wheat and barley. Hence, applications of

oz/acre before the four-leaf stage caused gross malforma-
ons of the stems and leaves, reduced height and interfered
ith the normal seed development in the main culms. However,
pplications during four to six leaf stages, this dose
nterfered with tiller development and markedly reduced seed
roduction in the main culm. Meanwhile, treatments at the
oot and early heading stages prevented largely kernel develop-
ent in both crops.

Moutschen et al. (1965), studied the action of 1-threitol-
,4 methane sulfonate in 3 plant species, Vicia faba,
ordeum sativum and Nigella damascena concluding that Vicia
aba was more sensitive than the two other species.

Krol et al. (1967),mentioned that some varieties of
riticum aestivum were tolerant to "2,4-D" sodium and deduced
hat this character might be inherted.

Krol et al. (1968), sprayed "2,4-D" sodium on barley and
oat plants at the 2 to 3 leaf stage and noticed that ears
produced from nodes and ear spikelets were affected.

Onki (1968), stated that visible gross morphological
effects were noted as low as 0.1 p.p.m added TIBA (2,3,5
triodobenzoic acid). Meanwhile, growth reductions occurred
only at 10 p.p.m. TIBA.

Bagaev et al. (1969), indicated that "2,4-D" octyle ester
(C_1-C_4) at 0.35 kg/ha retarding spring wheat growth from

illering right at the fully ripe stage. Yield reduction ecreased from 17 to 8% with the increase in fertiliser rate rom 20 - 120 kg P_2O_5/ha.

Liang et al. (1969), indicated that grain yield, kernel eight and kernel number in sorghum plants were significantly ffected by herbicides treatment e.g. "atrazine", 2,4-D, oil nd their combinations from the control.

Rudich et al. (1969), proved that grain yields in wheat ere significantly increased by (2,4-D + Chloromequat) at the arly growth stage. In spite of the previous deduction, no ignificant effect was obtained from either compound alone at his stage. Late applications of chloromequat alone or in ixture with"2,4-D"or"MCPA"(2-methyl-4-chlorophenoxy acetic cid) significantly increased yields. However, addition of hloromequat reduced the spike deformation effects caused by MPCA alone but not those caused by"2,4-D".

Tabolina (1969),concluded that 2,4-D octyle ester (C_7-C_9) reduced tillering and 1000 grain weight when applied at the developmental stage of wheat with different rates of phosphorous fertiliser.

Veovodin et al. (1969),proved that wheat plants were most sensitive at 3-leaf to tillering stages and most tolerant at the late tillering to early shooting stage. Durum wheats were most tolerant to 2,4-D than soft wheats. The 2,4-D retarded

growth at the week after treatment.

Didel'Nant et al. (1970), concluded that "2,4-D" butyle induced activation of IAA oxidase in cotton plants and reduction of its inhibitors, leading to the decrease of IAA and that might be one of the causes of cotton growth inhibition.

Glabiszewski (1970), stated that root growth of maize was inhibited by "2,4-D" but stimulated by triazines and to a lesser extent by ureas. Meanwhile, Ramord and Igran 50 caused temporary inhibition of root and shoot growth while all other herbicides proved stimulatory.

Johnston et al. (1970), showed that simazine caused an appericiable yield loss in beans where the soil was low in organic matter content.

Lewis (1970), declared no adverse effects of herbicides on maize stands or yields.

Peeper et al. (1970), assumed that dicamba reduced yields when applied to sorghum at 40 days old, whilst treatments after head emergence increased lodging and sometimes resulted in head damage at anthesis.

Saghir et al. (1970), stated that reduction in plant height was significant at all concentrations used in the case of barley and at 1000 p.p.m and above in the case of wheat. On the other hand, reduction of wheat grain yield was detected when treated by 5000 p.p.m at jointing stage and anthesis.

While barley suffered significant reduction in grain yield when treated by 2000-3000 p.p.m at the 3-leaf and boot to heading stages and at anthesis. Significant reductions were also observed in the 1000 kernel weight and test weight of the two crops at higher concentration.

Woon (1970), concluded that S-6115 (2-chloro-4-cyclopropylamino-6-isopropylamino-4-methyl-tetraphydro-1,2,4-oxadiazole-3,5-dione) were initially more toxic to maize than atrazine"but, unlike"VCS-438","S-6115"did not reduce yields.

Zinchenko et al. (1970), illustrated that changes in weight and height of plants were statistically related to chemical doses used as herbicides.

Amer et al. (1971), elucidated the effect of insecticide "Sevin" on some morphological aspects of germination in Vicia faba and Gossypium barbadence. Germinability of seeds of various crops was decreased by soaking the seeds in a saturated solution. "Sevin"caused also inhibition of primary root length and decrease in the percentage of shoot emergence of Vicia faba as root treated.

De Carvalho (1971), stated that application of"atrazine" and"simazine"treatment did not give any significant deleterious effects on maize production. The best results were found at the highest rate of"atrazine"(3 kg/ha a.e), however"2,4-D"at the applied rates gave no weed control.

shel (1972), showed that the phytotoxicity of methoprotryne n wheat was higher than that of tetraprotryne in wheat and was lso higher than that of tetrabutryne. Addition of small mounts of simazine to either one of the group methylthiotriazine onsiderably increased damage to wheat.

Fayed (1972), assumed that the height of maize plant increased with the increase of simazine up to the highest level, i.e., 6 lb (a.i) and 10 lb (a.e) in 1970 and 1971 experiment respectively. Both maize yield per plant or per faddan increased by simazine treatment.

El-Shafey (1973), stated that no significant response was detected in the grain yield production at the highest rate of atrazine (3 kg/ha a.e), while,"2,4-D"at the applied rates gave no weed control.

Schietinger (1973), mentioned that winter wheat yield increased following the use of soil-acting herbicides, principally urea and triazines. This was attributable to increases in the number of grains/ear and/or size of grain, while, more lasting effects on the yield, resulting from elimination of weed compitition or toxicity of the herbicides, were correlated with plant density.

2. CYTOLOGICAL STUDIES:

The direct effect of chemical substances especially herbicides, pesticides and fungicides on nucleus was scanty until Ryland (1948), Nygren (1949) and Doxy (1949) found various aberrations such as fragments and fusions of chromosome in dividing nuclei.

Unrau and Larter (1952), stated that "2,4-D" applied to cereal crops at any stage of growth produced various types of chromosomal aberrations. Stickiness of chromosomes was observed in a large number of P.M.C's resulting from changes in the chemical or electrostatic properties of the chromosomes. Fragmentations occurred probably by treatments in early stages of growth.

Martini (1966), indicated that structural aberration, aneuploid individuals and abnormalities of the physiology of meiosis (such as total or partial stickiness) were induced by mutagenic agents, i.e. E.M.S, D.E.S or ethyleneimine.

Wuu and Grant (1966 a), found that all the cells of barley plants germinated from seeds treated with Lorox solution for a period of 24 hours were abnormal in meiotic behaviour. These abnormalities included chromosome stickiness, chromosome clumping, chromatin body formation, cytoplasmic furrowing, unequal distribution of the chromatin material into daughter cells and asynchronous and multiple

cell division. The mode of action of Borox was considered to be as a radiomimetic compound.

Wuu and Grant (1966 b) carried out cytological studies on root tips of barley Hordium vulgare with one of 15 pesticides indicating that all the pesticides tested were effective agents in inducing chromosomal irregularities and phenotypic malformations, however, the data clearly showed that the pesticides acted as radiomimetic agents.

Liang et al. (1967), stated that abnormalities obtained from Sorghum P.M.C's sprayed with"atrazine"at a rate of (2.7 kg/ha) showed abnormalities consisting of multinucleate cells, bridges and increase chromosome numbers.

Wuu and Grant (1967 a), indicated that all of the tested pesticides on barley plants were capable of inducing chromosomal aberrations including stickiness, extreme clumping or coalescence""chromatin bodies", chromosome bridges, fragments and micronuclei. In addition asynchronous nuclear and cellular divisions were observed.

Wuu and Grant (1967 b) studied the chromosomal aberrations induced in somatic cells of Vicia faba by 15 pesticides at three concentrations (200, 400 and 600 p.p.m) for three time intervals (3,6 and 12 hours). All the pesticides were highly effective in inducing chromosomal aberrations in root tip cells which ranged from 9.19% to 21.27% for the different treatments. In general, an increase in duration of treatment increased the