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A Review

A new method of weed control and further evidence of a criticism of Levi and Crafts (1952), Molero and Blackhurst (1956), Carroll (1957) and Singhal and Sen's (1981)

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ABSTRACT

Foliar applications of 100, 200, 1200 mg/ml 2,4-D caused 20, 40, 60% mortality of *Solanum xanthocarpum* Schrad. & Wendl. plants after 6 days of treatment, while the plants treated with 25 and 50 mg/ml 2,4-D showed flowering after 32 and 48 days of treatment respectively. However, the flowering was completely suppressed in all the sets treated with 50 mg/ml and above. These observations were made in the sets treated at the pre-flowering stage. The sets treated with 50, 75, 100, 200 mg/ml 2,4-D showed flower development only up to first 4 days after treatment. It should be noted that even in these sets an initiation of new flowering was never found, however, the flower buds which appeared before treatment developed to maturity. The treatment of 1, 2, 5, 10, 15, 20, 25 mg/ml 2,4-D showed flowering up to 5 weeks after treatment. These observations were made in the sets treated at the post-flowering stage. The sets which were treated at the pre-flowering stage with 25 and 50 mg/ml 2,4-D showed two and one fruit on each plant respectively. The sets which were treated at the post-flowering stage showed 6, 4, 3, 2, 1, 1, 0.9, 0.8, 0.7 fruits per plant with the sets treated with 1, 2, 5, 10, 15, 20, 25, 50, 75 mg/ml 2,4-D respectively against 7 fruits per plant in control. On the 12th day cent percent mortality was found with the treatment of 1400 and 1600 mg/ml 2,4-D, however 40% plants were surviving with the treatment of 1200 mg/ml. Therefore, the lethal dose for *S. xanthocarpum* was proved to be 1400 mg/ml 2,4-D. From the present work as well as the previous work (Salgare, 1986, 2002) it is concluded that because of the suppression of the flowering of the weeds there will be no fruit formation and seed-setting at all. This will result in the complete suppression of the future generation. Moreover, the weed control would be achieved with a very low concentrations of the herbicides, which will be very economical. It will also avoid the danger of pollution and damage to the crop as well.

Key words : Weed Control, Weeds, Environmental Sciences, Herbicides.

INTRODUCTION

Farmers throughout the world have several common problems and eradication of weeds is one of them. In the case of some crops, the yield may be reduced by more than 50% due to unchecked weed growth (Mani, Arora and Gautam, 1968). Weed control is the most pernicious and troublesome problem. Weeds, though unwanted, are often prolific and persistent.

The weed control by chemical means has been replacing or supplementing traditional cultural methods in most of the agriculturally advanced countries. Due attention is being paid to the problem in these countries since the economic return from the crop is dependent upon it to a considerable extent. A large number of chemicals, inorganic, organic and auxin herbicides have been used for this purpose. Khosla (1967) stated that no lethal doses could be determined for *Achyranthes aspera* and *Cassia tora* since maleic hydrazide recrystalised at room temperature beyond 5400 ppm. In fact it is apparent that the dosage required to kill the weeds through its conductive tissue is often sufficient to kill the crop as well. Thus, Crafts (1946) reported that spray of 4% solution of sodium arsenite destroyed all barley plants and weeds growing in the same plot. Mitra (1952) and Shivapuri and Sinha (1953) noted some adverse effect of higher concentrations of 2,4-D on crop plants such as abnormalities and sterility of some of the florets and consequent reduction in the yield of wheat. Salgare (2002) doubted whether the chemical weed control is justified ?

Under such circumstances how far it is justified to follow this old practice ? Salgare stated that instead of the conductive elements we should make reproductive units (pollen, ovule, embryo) as the targets of weed control. In this connection it is worth quoting Rehm (1952) who stated that full male sterility was found with 5 ppm of 2,4-D, however, no definite conclusions on the female fertility of the tomato can be made at this stage. Even the work of Moore (1950), Naylor (1950), Jain (1959), Chopra, Jain and Swaminathan (1960), Seetharam and Kusuma Kumari (1975) and Salgare (2002) is encouraging in this respect. Studies in the 1930's showed that fungicides, such as Bordeaux spray, when used in orchards, often decreased fruit set. Investigators found that copper, mercury, or arsenic as spray residues on flowers or brought in by bees, decreased pollen germination, resulting in low fruit set (Eaton, 1957).

MATERIALS AND METHODS

Solanum xanthocarpum Schrad. & Wendl. is a very common weed found growing in the crop fields throughout the country. Foliar applications of 25-25-100, 200-200-1600 mg/ml 2,4-Dichlorophenoxy acetic acid (2,4-D) were made at 60 day old plants (pre-flowering stage) and 1,2, 5-5-25, 25-25-100, 200-200-1000 mg/ml 2,4-D at 110 day old plants (post-flowering stage) of *S. xanthocarpum* by air-compressor. The observations were recorded every

alternate day till the plants matured to the final stage of their life cycle, regarding the effect of 2,4-D on the morphology of leaves, flowering behaviour and mortality. Morphological abnormalities which occurred were recorded.

RESULTS AND DISCUSSION

Growth of plants of *Solanum xanthocarpum* was inhibited at all concentrations of 2,4-D after two days of treatment. The leaves of all the treated plants with 25-1600 mg/ml 2,4-D completely dropped down. On the 3rd day cotylidonary leaves treated with 1200-1600 mg/ml showed chlorosis at the apical region. Epinastic curvature was observed in leaves, petioles as well as stem apex with the treated plants on 3rd day. The leaves were injured at their margin, apex and at places on the lamina after 3 days of treatment. The injury increased at higher concentrations of 800 -1600 mg/ml and some leaves withered or become almost dry. A vertical splitting of petiole as well as lower part of the stem was observed. After 6 days of treatment 20, 40, 60% mortality was caused by the treatment of 100, 200, 1200 mg/ml 2,4-D. The plants treated with 25 and 50 mg/ml 2,4-D showed flowering after 32 and 48 day of treatment respectively, while the plants treated with distilled water (control) started flowering after 17 days of treatment. However, the flowering was completely suppressed in all the sets treated with 50 mg/ml and above 2,4-D. These observations were made in the sets treated at the pre-flowering stage. The sets which were treated at the post-flowering stage showed flower development only up to first 4 days after treatment with 50, 75, 100, 200 mg/ml 2,4-D treatments. It should be noted that even in these sets an initiation of new flowering was never found, however, the flower buds which appeared before treatment developed to maturity. The sets which were treated at the post-flowering stage showed flowering up to 5 weeks after treatment with 1, 2, 5, 10, 15, 20, 25 mg/ml 2,4-D treatments. The sets which were treated at the pre-flowering stage with 25 and 50 mg/ml 2,4-D showed two and one fruit on each plant respectively. The sets which were treated at the post-flowering stage showed 6, 4, 3, 2, 1, 1, 0.9, 0.8, 0.7 fruits per plant with 1, 2, 5, 10, 15, 20, 25, 50, 75 mg/ml 2,4-D treatments respectively against 7 fruits per plant in control. Salgare (1986) stated that the foliar applications of all the concentrations of 2,4-D above 100, 600, 800 mg/ml suppressed flowering permanently in the leguminous crops *viz. Phaseolus mungo, P. aureus, Cyamopsis tetragonoloba* respectively. Initiation of flowering in *P. mungo* was delayed by 2 weeks by the treatments of 5 and 10 mg/ml, by 3 weeks by 25 and 50 mg/ml and by 4 weeks by 100 mg/ml 2,4-D. The foliar applications of 5, 10, 25 mg/ml delayed an initiation of flowering by 2 and 4 days in *C. tetragonoloba* and *P. aureus* respectively, while by 3 days and one week in *C. tetragonoloba* and *P. aureus* respectively by 50 and 100 mg/ml 2,4-D treatments. Initiation of flowering in *C. tetragonoloba* was delayed by one week by the treatments of 200 and 400 mg/ml and by 2 weeks by 600 and 800 mg/ml 2,4-D treatments. Foliar application of 200 mg/ml 2,4-D delayed an initiation of flowering of *P. aureus* by 2 weeks, while the treatments of 400 and 600 mg/ml delayed by 3 weeks. Delay in flowering and fruiting due to the foliar application of 2,4-D was also observed by Dnyansagar and Khosla (1970) in *Cassia tora* and *Rulellia tuberosa*, by Bakale (1972) in *Alternanthera polygonydes* and *Xanthium strumarium*. Bakale (1972) stated that there was no flowering at all in the sets treated with 2,4-D of *Cressa cretica* throughout the duration of experiments. On the 12th day cent percent mortality was found with the treatments of 1400 and 1600 mg/ml 2,4-D, however 40% plants were surviving with the treatment of 1200 mg/ml. Therefore, the lethal dose for *S. xanthocarpum* was proved to be 1400 mg/ml 2,4-D.

From the present work as well as the extensive work Salgare (1996, 2002) it is concluded that because of the suppression of the flowering of the weeds there will be no fruit formation and seed-setting at all. This will result in the complete suppression of the weeds in the future generation. Moreover, the weed control would be achieved with a very low concentrations of the herbicides, which will be very economical. It will also avoid the danger of pollution and damage to the crop as well.

Alternative method of weed control is suggested by Singhal and Sen (1981) where they recommended that instead of killing the weed, suppress the seed germinability. It should be pointed out that Singhal and Sen's (1981) theory is challenged by Salgare (1996, 2002) stating that Singhal and Sen (1981) have forgotten that it is the reproductive stage of the weeds which consume maximum nutrients from the soil. Salgare (1996, 2002) recommended that instead of killing the weed suppress the flowering with a very low doses of the herbicides. It should be pointed out that Salgare (2002) doubted the practice of chemical weed control itself!

Levi and Crafts (1952), Molero and Blackhurst (1956) and Carroll (1957) have stated that MH does not show any residual effect on the soil. It should be pointed out that the findings of these workers are challenged by Salgare (2002), Salgare and Theresa Sebastian (1987). Salgare (2002), Salgare and Theresa Sebastian (1987) also observed the residual effect of dalapon, sodium arsenite, sodium penta chloro phanate and 2,4-D on the soil and on the succeeding crops. This shows that we must minimize the use of the higher concentrations of the herbicides.

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