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PHENOLOGY OF WEEDS IN WHEAT AS INFLUENCED BY WEED CONTROL*

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ABSTRACT

Phenological behaviour of *Spergula arvensis* L., *Fumaria parviflora* Lam., *Melilotus indica* L., *Phalaris minor* Retz., and *Convolvulus arvensis* L., indicated that *S. arvensis* and *C. arvensis* started germinating 8-10 d.a.s. of wheat, whereas *P. minor*, *F. parviflora* and *M. indica* germinated after irrigating wheat 21 d.a.s. at its crown root initiation stage. Marked differences were observed also in the maturity stage of the weeds. *F. parviflora*, *P. minor* and *S. arvensis* matured earlier to wheat and shed their seeds to contaminate the soil, whereas *M. indica* and *C. arvensis* matured alongwith the crop, and their seeds contaminated the wheat grain.

KEY WORDS: Weed phenology, Weed control, Wheat.

Distinct from periodicity and aspection, the phenology refers more to the appearence of the manifestations at certain seasons of the year, rather than to their cyclic nature. Various physiological phenomena which alter on account of changed environment, have practical value in integrating many environmental factors which can be made a tool to predict the critical time of their successful control (Hanson and Churchill, 1961). Harper (1956) also observed that changes in the phenology of weeds were perhaps the most likely ones to follow a continued and systematic programme of herbicide usage. Continued spray of a herbicide at one stage of development could lead to the evolution of phenologically different plants.

In the mixed population of weeds where the selected herbicide may kill the dominant species, it will also at the same time have an important

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selective action on subsidiary, but slightly more tolerant species. It may not be out of place here to mention that phenological events may vary considerably from year to year and with the change in micro-climate because of diversified weed flora on account of various weed control measures.

MATERIALS AND METHODS

Research was conducted during winter 1982, at the Agronomy Farm of Rajasthan College of Agriculture, Udaipur on a moderately fertile vartisol with pH 8.5 and per cent organic carbon content of 0.80. Wheat var. HD 4530 was sown at 125 kg/ha using a 23-cm drill spacing in third week of November with uniform application of NPK (100: 40:40 kg/ha).Phenological observations were recorded in plots treated with postemergent 2,4-D at 0.5 kg/ha, metoxuron at 1.25 kg/ha, methabenzthiazuron at 1.0 kg/ha, isoproturon at 0.75 kg/ha, fluchloralin at 1.0 kg/ha and bentazon at 1.0 kg/ha. Their combinations were also applied at rates of 25 and 50 per cent of respective straight herbicide also with fixed dose of 0.5 kg/ha 2,4-D. Herbicides were applied as broadcast at 800 l/ha using a hydraulic knapsack sprayer with floodjet fan nozzle. Fluchloralin and its tank mixture with 2,4-D were sprayed and incorporated in the soil alongwith irrigation water at C.R.I. stage of wheat (21 d.a.s). Other herbicides were applied 30-35 d.a.s. Crop was weeded manually twice, each at 30 and 45 days growth stage. Weeding treatments were evaluated with unweeded check.

Phenological observations like germination, vegetative growth, flowering, fruiting, seed maturation and death were recorded. Various stages in life cycle of weeds was studied periodically, reflecting the treatment effect on growth pattern of a weed. A fortnightly study was carried till crop harvest.

RESULTS AND DISCUSSION

Of the weed flora encountered in the experiment, **S. arvensis**, **F. parviflora**, **M. indica**, **C. arvensis** among broadleaf weeds and **P. minor** as annual grass were found dominant. Phenological behaviour of there dominant weeds are as under:

i) **Spergula arvensis** L.

In undisturbed, control plots, **S. arvensis** began to germinate 8-10 d.a.s. of wheat. The germination continued in flushes till mid January. But in herbicide treated plots this aspect of phenology was altered drastically. In fluchloralin plots, *S. arvensis* establishment was delayed up to first fortnight of December while with fluchloralin plus 2,4-D it was so up to end of December. It was evident that mixture acted longer than fluchloralin alone despite the lower dose of fluchloralin in the mixture.

The vegetative growth of ***S. arvensis*** in unweeded plots was observed till January. Same was the case with some seedlings that were missed in the manually weeded plots. In plots treated with postemergent 2,4-D (0.5 kg/ha), isoproturon (0.75 kg/ha), tank mixture of 0.25 kg/ha methabenzthiazuron plus 2,4-D, 0.375 kg/ha isoproturon plus 2,4-D, 0.25 kg/ha fluchloralin plus 2,4-D, the vegetative growth of survived seedlings of ***Spergula*** continued till January end, whereas metoxuron (1.25 kg/ha), methabenzthiazuron (1.0 kg/ha), fluchloralin (1.0 kg/ha), tank mixtures of 0.3132 or 0.625 kg/ha metoxuron plus 2,4-D, 0.5 kg/ha methabenzthiazuron plus 2,4-D, bentazon and 2,4-D each at 0.5 kg/ha and 0.187 kg/ha isoproturon with 2,4-D did not allow the weed to grow beyond its vegetative growth and erased them completely.

Flowering of ***Spergula*** in weedy plots began in the latter half of January and continued till first fortnight of February but tank mixture of 0.25 kg/ha bentazon plus 2,4-D did not permit its flowering after January itself.

Fruiting and maturity of *Spergula* in the atmosphere of undisturbed weedy microclimate initiated soon after its flowering phase was over, in the first fortnight of February and continued till crop harvest. Therefore, ***S. arvensis***, as such in all three phases was harvested alongwith wheat. In manually weeded plots, fruiting of escaped ***Spergula*** continued up to February end but thereafter did not allow its maturation, missing thus the chance of contaminating crop harvests. And so also in 2,4-D plots, few of these, matured and dropped their seeds on ground, during late March. Also, it was interesting to observe that maturity of the weed, in plots treated with tank mixture of fluchloralin and 2,4-D, initiated during early February.

ii) ***Fumaria parviflora*** Lam.

In undisturbed environment of unweeded check, the germination and the vegetative growth of ***Fumaria*** were observed profuse during later half of December and that germination continued till mid January, and the vegetative growth was over by January. Similarly, in intra row space of manually weeded plots, the leftover plants also continued to show vegetative phase of growth till January end, whereas tank mixture of 0.25 kg/ha fluchloralin with 2,4-D (0.5 kg/ha) did not allow germination even up to December end as such the weed emerged in early January.

Flowering in weedy microclimate occurred in the later half of January and continued till mid February, but in variance with unweeded check microclimate, these suppressed **Fumaria** plants did not show meaningful seedling and withered away during February itself. The crop harvest was thus free from seeds of **F. parviflora**. Postemergent 2,4-D and isoproturon inflicted interesting effects on phenology and **Fumaria** did not grow beyond flowering, like in manually weeded plots. Postemergent metoxuron (1.25 kg/ha), fluchloralin (1.0 kg/ha) and methabenzthiazuron (1.0 kg/ha) did not allow the weed to grow beyond even vegetative phase and withered away during January itself, as in plots treated with tank mixtures of 0.5 kg/ha 2,4-D with metoxuron (0.625 kg/ha), fluchloralin (0.5 kg/ha) and bentazon (0.25 kg/ha).

iii) **Melilotus indica** L.

Melilotus indica L. germinated in flushes during December and continued till mid January in undisturbed weedy microclimate. In contrast, tank mixture of 0.5 kg/ha 2,4-D and isoproturon (0.375 kg/ha) did not allow the weed to even germinate.

Vegetative growth of M. **indica**, in weedy microclimate continued up to January and same was checked thereafter. Simultaneously, flowering of **M. indica** initiated in the latter half of the January and continued up to March, whereas postemergent 2,4-D (0.5 kg/ha) checked the flowering of M. indica after mid February. Postemergence application of substituted urea herbicide **i.e.** metoxuron (1.25 kg/ha), isoproturon (0.75 kg/ha) and methabenzthiazuron (1.0 kg/ha) was found even more hostile than 2,4-D and caused death of the weed right in latter half of January. Methabenzthiazuron acted faster in killing this weed than other herbicides tried. Postemergence application of bentazon (1.0 kg/ha) and fluchloralin (1.0 kg/ha) permitted flowering of **M. indica** up to mid March, whereas tank mixture of bentazon and 2,4-D each at 0.5 kg/ha did not allow the weed to flower beyond mid February and thereafter weed withered away.

Fruiting and seed maturation which initiated in March continued till crop harvest, in weedy microclimate and thus **M. indica** plants as such, were harvested alongwith wheat and had very good opportunity to admixture its seed wheat grain, whereas in manually weeded plots, survived but suppressed plants of **M. indica** matured in mid March and then withered away before crop harvest. Postemergent bentazon (1.0 kg/ha), fluchloralin (1.0 kg/ha), tank mixtures of 0.5 kg/ha 2,4-D with methabenzthiazuron (0.25 kg/ha) or fluchloralin (0.5 kg/ha) permitted the escaped plants of the weed to grow till maturity and thus allowing admixture of its seed with wheat grain, to certain extent.

iv) **Phalaris minor** Retz.

Phalaris minor germinated late in December, after irrigating wheat at its crown root initiation stage without showing repeated flushes, whereas tank mixture of 0.5 kg/ha 2,4-D and fluchloralin (0.25 kg/ha) delayed its germination and as such weed emerged in early January.

Its vegetative growth in all plots continued up to mid February, thereafter it entered in flowering phase till February end, although stray flowering was observed also during March. Except 2,4-D where flowering continued up to March, all other herbicides tended the weed to complete its flowering by mid March. In fact, March was the month for peak seed formation and maturity of **P. minor.** The weed partly shed its seeds, although the plants did not wither away and continued to stand with some mature seeds in their ears, even at crop harvest during April. Besides this, the phenology of **P. minor** was least affected by various weed control treatments.

v) **Convolvulus arvensis** L.

In undisturbed plots of unweeded check, **C. arvensis** germinated in flushes during

December and January. As such the phenology of the weed in terms of germination was not affected in manually weeded and in plots treated with post-emergent metoxuron (1.25 kg/ha) fluchloralin (1.0 kg/ha), isoproturon (0.75 kg/ha).

In the environment of uncontrolled growth of weeds, its foliage continued to grow up to mid February. Postemergent bentazon (1.0 kg/ha) was found to have a very pronounced effect in diverting the course of phenology of **C. arvensis** and thus did not allow the weed to flower and thereafter seed setting at any stage up to crop harvest and withered away, thus **C. arvensis** free crop was harvested. Postemergence application of 2,4-D (0.5 kg/ha) did not allow **C. arvensis** to wither away to any stage but escaped seed maturation. Tank mixture of bentazon and 2,4-D each at 0.5 kg/ha forced this perennial broadleaf weed to wither away completely in January itself. Likewise tank mixture of 0.625 kg/ha metoxuron or 0.375 kg/ha isoproturon with 2,4-D (0.5 kg/ha) tended to avoid seed formation and maturity. Thus **C. arvensis** remained in vegetative phase and as such withered away under crop canopy in later March and April without contaminating wheat grains.

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