Chapter-I

INTRODUCTION

Wheat (*Triticum aestivum* L. emend Fiori & Paol) is a feeding bowl to mankind occupying a premier position of all the staple food grain crops and an intellectual challenge that posses in a range of biological disciplines, archaeology, social and economic history. It is grown around the world across a wide range of environments and more land is devoted to the production of wheat than any other crop. It is a number one food grain consumed directly by human beings and it is estimated that more than 35 per cent of the world population depends on wheat. Wheat is one of the most important staple food crops of India grown in diverse agro climatic conditions from 11° N- 35° N latitude and 72° E- 92° E longitudes. In India, it is the second most important food crop next to rice and it contributes nearly 35 per cent to the national food basket. Its contribution to the green revolution is significant. Among winter cereals, it contributes about 49 per cent of food grain production. During the year 2010-11, the total foods grain production of 244.77 million tones and wheat was grown over an area of 29.6 million ha with a production of 86.87 million tones with an average productivity of 3407 kg/ha (DES, 2012).

Weed infestation is one of the major yield constraints of wheat production in India. Wheat yield is severely reduced due to infestation of broad spectrum weed flora in different areas (Singh *et al.*, 2003). Weeds are unwanted or undesirable plants and most omnipresent class of pests that interfere with crops
for water, soil nutrients, light, space and thus reduce crop yields. Weeds are competitive and adaptable to all the adverse environments. It has been estimated that in general weeds cause 5% loss to agricultural production in most developed countries, 10% loss in less developed countries and 25% loss in least developed countries (Gupta, 2004). Arvindson (1987) also observed that weed caused 10 to 50% loss in grain yield of wheat. It includes reduction in crop yields and production efficiency and erosion of crop quality. The yield deduction due to weed varies from 34.3% to 89.8% depending upon the crop. In Rice (30-35%), Wheat (15-30%), Maize, Sorghum, Pulses, Oilseeds (18-85%), Sugarcane (38.8%), Cotton (47.5%), Sugar beet (48.4%) and Onion (90.7%) (Gupta, 2004). Infestation of grassy weeds like *Phalaris minor* L. & *Avena ludoviciana* L. and broadleaf weeds like *Chenopodium album* L., *Chichorium intybus* L. and *Rumex dentate* L. are increasing at an alarming rate thus culminating wheat yield reduction by 18 to 73% depend upon the magnitude of infestation (Arvindson, 1987). The low temperature is favorable for germination and growth of *Chenopodium sp.* (Hirano, 1991) that highly infests winter crops like wheat. The predominance of broadleaf weeds in wheat field (Mamun and Salim, 1989). Uncontrolled weed growth reduces crop grain yield up to 57% (Singh *et al.*, 1997) due to severe weed infestations, the wheat productivity in farmers’ field becomes very low. Numerous approaches have been in practice for handling the problem of weed infestation. Chemical weed control seems indispensable and has proved efficient in controlling weeds (Kahramanoglu and Uygur, 2010), and hence currently about two-third, by volume, of the pesticides used worldwide in agricultural production are herbicides. Indiscriminate use of
herbicides for weed control during the past few decades has resulted in serious ecological and environmental problems, such as resistance, shifts in weed flora that are more closely related to the crops. Hence minor weeds becoming dominant (Heap, 2007) and greater environmental & health hazards and sky rocketing input prices, crop injury and reduced profits are issues that need to be solved through reduction in pesticide uses (Rao, 2000). Chemical weed control is a very effective method for suppressing weeds, and herbicides proffer a substantial boost in crop productivity through efficient weed control (Santos, 2009). But excessive and non-judicious use of herbicide may lead to crop injury, human and animal health concerns, soil and water pollution and herbicide resistance in weeds (Jabran et al., 2008 and Farooq et al., 2011). Herbicidal weed control is well established in many other wheat growing countries but in Indian farmers mainly depend on manual hand weeding. Under the changing of socio-economic conditions, availability of the agricultural laborers is reducing day by day that hampered agricultural operations seriously. Grain yield of wheat can be increased through proper weed management. Application of herbicides may be an effective and alternative option for proper weed management to boost up the wheat grain yield (Singh et al., 2003).

Isoproturon alone as well as in combination with 2, 4-D was not toxic to wheat plants. Isoproturon was toxic to Phalaris minor L. and some other broadleaf weeds. Tank mixed application of Isoproturon and 2, 4-D was highly toxic to Parthenium hysterophorus L. and Chenopodium album L. which took about seven days to kill them, whereas Anagallis arvensis L., Lathyrus aphaca L., Vicia hirsute L. were killed within 14 days Cyperus rotundus L. and Cynodon dactylon L. were not affected by the herbicide
combination. Tank mixed application of Isoproturon (1.0 kg a.i./ha) and 2, 4-D (0.5 kg a.e./ha) resulted in minimum weed dry weight. The treatment also resulted in least dry weight of broadleaf weeds and sedges. Highest grain yield of wheat was obtained from the same treatment (Sarkar, 1997). The corresponding suppression in weed density and dry weed biomass with a full dose of sulfosulfuron was 91-95% and 97-100%. Grain yields of wheat from treatments with sorgaab in combination with low doses of sulfosulfuron were the same as the recommended dose of sulfosulfuron (Jamil et al., 2007). It is reported that Metribuzin, the most potent weed killer, eliminated Chenopodium album L. the major weed in wheat and gave excellent control of all other weeds. It controlled the Convolvulus arvensis L. until harvest of the crop. In comparison to the herbicides, hand weeding, Metribuzin was significantly superior in arresting both weed population and weed dry matter (Pandey and Verma, 2002). Weeds must be controlled up to 80% or more depending upon the nature of the weeds and the extent of infestation to reduce the losses caused by weeds and to manage it to the economic threshold level. On an average weeds cause 20-30% losses in different crops in India. Losses due to weeds exceed beyond Rs. 120 billion on national level, whereas wheat alone accounts for more than 30 billion. Losses due to weeds in major cereal crops of India exist in the range of Rs.40, 30 and 4 billion for rice, wheat and maize, respectively (Anonymous, 2005). Amongst various factors adversely influencing crop productivity, weed infestation in crop lands remains the most devastating one. Weed management increase the grain yield by 64 percent when compared with weedy check (Bharat and Kachroo, 2007). To ensure satisfactory weed control, even under unfavorable
regimes of crop production factors, manufacturers often recommended higher than necessary doses of herbicide. However, it is not always necessarily to apply full herbicide dose (Talgre et al., 2008) and there can flexibility regarding herbicide rates depending on the weed spectrum, densities, their growth stage and environmental conditions of the site. Moreover, modern weed science also emphasizes following an ecological approach based on keeping weed populations below threshold levels rather than eradicating them (Barroso et al., 2009). Numerous herbicide molecules at lower than-recommended rates are effective enough to provide satisfactory weed control without sacrificing (Fogelfors, 2002; Walker et al., 2002; Auskalnis and Kadzys, 2006; Barros et al., 2007).

Reduced herbicide doses seem to offer a promising tool for decreasing herbicide usage across the globe. Weed species also tend to vary in their susceptibility to different doses of a specific herbicide. Zhang et al. (2000) was reported herbicide doses and concluded that weed control efficiency tends to be lower and more erratic at reduced doses than at recommended doses, although it was commercially acceptable (60-100%) in most cases. Different herbicides viz isoproturon and 2,4-D have been recommended for commercial used by the farmers for control of weeds in wheat crop. Malik et al. (1995) reported that resistance of Phalaris minor L. against isoproturon in our country. Therefore, there is need of herbicides which may provide broad spectrum weed control including grassy and non-grassy weeds and gave a commercial substitution of isoproturon and 2,4-D. In light of these facts, isoproturon, isoprpturon + 2, 4-D
combination, sulfosulfuron, fenoxaprop-p-ethyle, clodinofop and metribuzin were tested to evaluate the performance of these herbicides on weeds and production of wheat crops.

In the view of above facts the present investigation entitled “Studies on weed management in wheat with low doses herbicides” at Agricultural Research Farm (Pili Kothi) of Tilak Dhari Post Graduate College, Jaunpur (U.P.) with the following objectives:

1. To study the effect of weed flora and their growth under different herbicides.
2. To study the effect of herbicides on growth and yield of wheat.
3. To find out the N, P and K content, uptake by crop and their depletion by weeds.
4. To work out the economics of different treatments.