**REVIEW OF LITERATURE**

Slife (1956) reported that 2,4-D and 2,4,5-T reduced soybean yields about equally. Silvex applied at the bloom stage was the only herbicide that reduced germination and it only by 5 %.

Slife (1956) found that 2,4-D reduced germination of seeds produced by treated plants.

Slife (1956) concluded that Seed yields were not affected by 1/161 or 1i8 lb/A of 2,4-D acid in the amine form when applied to soybeans 3 to 5 inches tall and 7 to 9 inches tall. The yields were affected slightly at the same rates when soybeans were sprayed at 18 to 20 inches tall. The 14 and 1/2 lb/A rates of 2, 4-D affected yields at all stages but were less severe when applied at 3 to 5 inches tall.

Schultz (1967) observed that in corn (*Zea mays* 1.), soybean (*Glycine max* 1.) grain sorghum (Sorghum bicolor) and cucumber seed germination was not inhibited when they were treated with trifulralin in laboratory. The same response was noted for cotton (Gossypium hirsutum) by Hassawy and Hamilton (1971). Since the germination processes are not directly inhibited by the dinitroaniline herbicides, so the toxic effect must take place between the time of radicle and shoot emergence of seedlings from the soil. This very conclusion was given by Fayte *et al*. (1982). Kolhe *et al*. (1984) also found that butachlor, penditnethalin and thiobencarb did not inhibit germination of rice seeds but toxicity due to herbicide appeared after germination.

Wax *et al.* (1969) found that the 2,4-D treatments at either stage of growth and the dicamba and picloram treatments at the pre-bloom stage had little effect on germination of the harvested seed. In contrast, the higher rates of dicamba and picloram applied at the bloom stage markedly reduced germination percentage.

Caviness and Johnson (1971) reported that spraying of Paraquat at the rate of 0.37 lb/acre 25 days before maturity reduced oil, protein content and deteriorated the seed quality.

Klingman and Murray and (1976) found that there was no effect or only minimal effect on germination and seedling development from the glyphosate herbicide treatment. However, paraquat when used under such extreme conditions greatly reduced stands of seedlings.

Baur *et al*. (1977) found that glyphosate reduced seedling survival and increased abnormal seedlings when applied to *Sorghum bicolor* (L.) Moench (sorghum) with 30 to 40% moisture content.

Whigham and Stoller (1979) showed reductions in seedling growth from glyphosate compared with paraquat with little timing effect.

Whigham and Stoller (1979) found that Application of paraquat 3 and 4 week before harvest was effective for desiccation of soybean foliage but reduced soybean yield.

Whigham and Stoller (1979) reported that Glyphosate at 1.7 and 3.4 kg/ha applied 2, 3, or 4 weeks before harvest also reduced soybean seed germination in research.

Eastin (1980) observed a reduction in head rice yield of 2% when sodium chlorate at 5.04 kg/ha was applied at 7 days compared with 3 days pre-harvest.

Azlin and McWhorter (1981) concluded that germination of soybean seed was reduced at 300 C only when glyphosate was applied at 2.24 and 3.36 kg/ha 23 to 29 days before harvest, or at 3.36 kg/ha applied 15 to 21 days before harvest. At alternating temperatures (10.60 C for 72 h followed by 300 C for 72 h), all treatments applied 23 to 29 days before harvest reduced soybean seed germination; glyphosate at 1.12, 1.68, and 3.36 kg/ha applied 15 to 21 days before harvest also reduced germination. Seed from plots treated with glyphosate 23 to 29 or 15 to 21 days before harvest produced atypical soybean plants.

Azlin and McWhorter (1981) found that glyphosate applied more than 2 weeks before full maturity of soybeans could be detrimental to soybean yields and to the quality of soybean seed. Glyphosate applied 7 to 12 days before harvest could be useful in providing future control of perennial weeds without adverse effect on soybean yields and seed quality.

Azlin and McWhorter (1981) reported that Germination was reduced by glyphosate at 1.12 to 3.36 kg/ha when applications were 15 to 21 days before harvest.

Azlin and McWhorter (1981) found that Oil content was reduced when glyphosate was applied at 3.36 kg/ha 23 to 29 days before harvest.

Soplin (1981) revealed that glyphosate consistently reduced seed germination and seedling vigour when sprayed on plants with seed at or near physiological maturity.

Hampton and Hebblethwaite (1982). reported that Glyphosate can be applied preharvest to cereal crops for control of annual and perennial grass and broad-leaved weeds.

Cerkauskas *et al.* (1982) indicated that application of glyphosate at 3.83 kg a.i./ha at stage of beginning maturity caused reduction in seed germination of soybean.

Cerkauskas *et al.* (1982) found that Desiccation of plants by paraquat significantly reduced seed weight and germination at all locations and increased the incidence of Alternaria and Phomopsis spp. at Urbana. Analysis of the combined data from the Brazilian locations showed a significant decrease in seed germination for all treatments except paraquat sprayed on the UFV2 at R7 and sodium chlorate: sodium borate sprayed on UFV1 at R7.

Prakash and Pahwa (1984) found that 1.2 kg methabenzthiazuron or pendimethalin, 0.6 to 1.2 kg diclofopmethyl, 0.5 to 1.0 kg fluchloralin and 0.1 to 0.2 kg oxfluorfen/ha applied as pre-emergence descreased root length but not shot length. Shoot growth inhibition has been reported in various plant species such as in cotton by Oliver and Frans (1965), Stendifer and Thomas (1965), Hess and Bayer (1974), in soybean by Burnside (1971), Kust and Struckmeyer (1971), Swann and Behrans (1972), Swanson (1972). At later stages of growth, the shoot dry weight was increased with 1.0 to 1.5 kg methasenzthiazuron, 0.6 kg diclofomethyl, all rates of fluchloralin, 1.5 to 2.0 kg pendimethalin and 0.1 kg oxyflurofen.

Shad and Chaudhary (1985) found that trifluralin at 0.50 kg/ha and 0.75 kg/ha delay germination by 5 - 7 days as compared to the control in chickpea.

Semidey and Almodovar (1987) found that 1.68 to 6.72 kg/ha Oxyfluorfen used as pre-emergence significantly reduced the germination by 20% in pigeon pea.

Bollich *et al.* (1988) conducted investigation to determine the influence of pendimethalin and trifluralin on soybean. Pendimethalin and trifluralin applied at rates of 1.1, 1.7 and 2.2 kg/ha delayed emergence and injured soybean seedlings. Dry weight also decreased with all rates of herbicide during the vegetative growth stages. Seedlings injury was severe at 1.7 and 2.2 kg/ha for both herbicides.

Pahwa *et al*. (1988) studied the effect of pendimethalin applied to the soil surface @ 1.0, 1.5 and 2.0 kg/ha and fluchloralin @ 0.7, 1.0 and 1.25 kg/ha in pots 2 days after sowing of pigeon pea. The length of main stem and primary root was reduced significantly while fresh and dry weights of shoots were reduced initially, the fresh and dry weights of roots increased significantly at lower concentrations and decreased at higher herbicide concentrations.

Ratnayake and Shaw (1992) revealed that paraquat and glufosinate reduced seed weight when applied at RS and R6. Glyphosate and AC 263,222 reduced seed germination when applied at RS, R6, and R7 growth stages, and normal seedling percentages were also reduced by glyphosate at these growth stages. Glufosinate and AC 263,222 affected normal seedlings only at R5 and R6. Soybean hypocotyl and primary root lengths were reduced by glyphosate and AC 263,222 applications at R5 and R6, whereas glufosinate and paraquat did not affect these variables. Glyphosate applied at R5 reduced shoot weight in 1 month old soybean plants.

Ratnayake and Shaw (1992) revealed that glufosinate and glyphosate reduced seed weight 12% when applied at R7. Seed weight was not affected by any herbicide applied at the R8 growth stage. Glufosinate and paraquat applied at R7 reduced germination 26 and 22%, respectively, while AC 263,222 and glyphosate reduced germination 11 and 20%, respectively. The herbicides applied at R8 did not affect sicklepod seed germination.

Darwent *et al*. (1994) applications of glyphosate at rates of 0.45, 0.9 and 1.7 kg ai ha-1 to wheat resulted in little or no difference in 1000-seed weight, sample density, seed germination and protein content.

Campbell *et al.* (1998) found that Glyphosate also reduce the percentage of mature seedheads but had little impacts on germination of the seeds and no effect on the growth of the seedlings from the seeds.

Zollinger *et al*. (1999) reported that an application of glyphosate prior to the hard dough stage or physiological maturity caused decreases in kernel weight and kernel size.

Bennett and Shaw (2000) found that glyphosate applied prior to plant harvest, especially at earlier maturity stage, inhibits the seed germination, emergence and growth of offspring plants. This effect, however, depends mostly on the development stage at which desiccation is performed and dose of glyphosate.

Yenish and Young (2000) application of glyphosate in three maturity stages of wheat milk stage, soft dough and hard dough stage at the doses of 0.62 and 0.84 kg ha-1.

Wilson and Smith (2002) suggested that dry bean seed weight and seed yield were reduced by all harvest-aid treatments applied when only 5 to 7% of the seedpods were yellow. Herbicides did not affect dry bean seed yield, weight, or germination if treatments were delayed until 77 to 85% of the seedpods had turned yellow.

Baig *et al*. (2003) showed that pre-harvest applications of glyphosate reduced seedling shoot weight of pea.

Blackburn *et al.*(2003)reported that the application of glyphosate at 1%, 10%, or 100% of an 890 g ai ha-1 rate to soybean near seed maturity had significant effects on germination and/or growth of the resulting F1 generation.

Manthey *et al*. (2004) studied that effect of pre-harvest application of herbicide, including glyphosate, paraquat and 2,4-D and observed a decrease in 1000-kernel weight (TKW) when glyphosate was applied at the soft dough stage.

Emine *et al*. (2007) conducted experiment in Diyarbakir, Turkey, to study the effect of thidiazoron + diuron application at 40, 50, 60 and 70 % boll opening stage of cotton. They showed no significant difference with respect to ginning percentage, 100 seed weight, seed germination percentage, fiber fineness, fiber length, fiber strength. Which means quality of parameters of cotton were not affected by the treatments.

Demir *et al*. (2008) suggested that stage of maturity at harvest is one of the most important factors that can influence the quality of seeds. Therefore, successful seed production depends on detection and prompt harvesting at appropriate time.

Albrecht *et al.* (2012) found that the decrease on seed germination for herbicide applications in the different development stages (V6 and R2) with the increase in doses of glyphosate.

Mishra *et al.* (2013) reported that application of imazamox at 350 ml/ha as early post-emergence caused more reduction in the density and dry weight of all the dicot weeds. Because it is readily absorbed through the roots and foliage, translocation in the xylem and phloem through the plant and accumulated in growing points.

Jaskulski and Jaskulska (2014) found that glyphosate applied at the dose of 2.0 kg ha-1 decreased the thousand grain weight and already at the dose of 1.0 kg ha-1 decreased the grain germination energy, length and weight of primary roots.

Mcnaughton *et al.* (2015) suggested that Glyphosate and saflufenacil accumulate in dry edible bean seeds desiccated in preharvest, especially when applied before physiological maturity.

Parmar *et al.* (2017) reported that the seed yield per hectare of soybean was higher under two hand weeding at 20 and 40 DAS (922.22 kg ha-1 ) followed by imazethapyr + imazamox @ 70g a.i. ha-1 (797.22 kg ha-1 ), quizalofop-ethyl @ 50 g a.i. ha-1 fb chlorimuron-ethyl @ 9 g a.i. ha-1 (769.44 kg ha-1 ) and chlorimuron-ethyl @ 9 g a.i. ha-1 (741.67 kg ha-1 ) than pre plant incorporation of glyphosate, pre emergence application of pendimethalin and alachlor and post emergence application of quizalofop-ethyl @ 50 g a.i. ha-1 and weedy check (436.11 kg ha-1 ).Uncontrolled weeds in weedy check resulted yield loss of 52.25% in soybean.

Fipke *et al.* (2018) reported that pre-harvest application of the herbicide glufosinate-ammonium does not affect the physiological quality expressed by the vigour and germination of seeds in the wheat crop.

Fipke *et al.* (2018) found that the application of non-selective herbicides on wheat pre-harvest impairs the physical and physiological quality and promotes faster deterioration.

Perboni *et al.* (2018) found that 2,4-D+glyphosate reduces germination of wheat seeds when applied in the soft dough to hard dough stage.

Rosado *et al.* (2019) found that Application of paraquat molecule at the R8 stage and the paraquat + diuron mixture at the R8/R9 stage reduced the viability and vigour of the bean seeds, and compromised yield.

Scholtes *et al.* (2019) suggested that soybean response to 2,4-D and dicamba can be variable within vegetative or reproductive growth stages; therefore, specific growth stage at the time of exposure should be considered when evaluating injury from off target movement. In addition, application of dicamba near susceptible soybean within the V4 to R2 growth stages should be avoided because this is the time of maximum susceptibility

Malalgoda *et al.* (2020) reported the effect of pre-harvest glyphosate applied at different stages of maturity, namely at the soft dough stage (45% moisture content) and the ripe stage (physiological maturity/30% moisture content and recommended application stage), on different spring wheat quality characteristics, ranging from kernel quality to end-product baking performance.