**Results**

**Effect of herbicide spray at crop maturity on weed population**

The soil moisture in the seed production experimental plot and other plots was high due to rainfall during seed crop maturity. High soil moisture caused high weed growth. The total number of weed population in NRC 130 and NRC 86 at crop maturity stage was 218 and 231 in 4x2 m2 area respectively. The type and intensity of weeds in field of NRC 130 and NRC 86 was almost same. The major weeds were *Euphorbia hirta, Amaranthus viridis, Commelina benghalensis, Echinochloa colona and Cyperus rotundus.*

The time taken to kill weeds by different herbicides was different on the basis of mode of action and type of herbicides. Paraquat dichloride being a contact herbicide it killed most of the weeds in 3 days, followed by broad spectrum systemic herbicide glyphosate which took 6-7 days. The Imazethapyr + Imazamox which is selective herbicide took more than 8 days to kill. The additional effect of paraquat and glyphosate was that soybean plants which were about to dry and had green foliage also became dry along with the weed plants. The selective herbicide Imazethapyr + Iimazamox killed only the weeds bud had negligible effect on soybean plants. (Table 1)

The number of weed plant killed by herbicide was indicated by the reduction in number of weeds after applying 3 types of herbicides Imazethapyr + Imazamox, Glyphosate and Paraquat. High death rate of weed plant was recorded in paraquat followed by glyphosate whereas Imazethapyr + Imazamox has recorded lowest. The number of weeds in NRC 130 and NRC 86 plots were 71 to 78 per 8 m2. The remaining weed population in the treated plots varied for different treatments. Paraquat treated plot of NRC 130 and NRC 86 had 3 and 4 weeds, Glyphosate treated plots had 14 to 15 weeds and Imazethapyr +Imazamox treated plots had 31 and 32 weeds respectively. The death of weed in case of paraquat was 94 and 96% in NRC 130 and NRC 86, in case of glyphosate it was 81% in both the varieties and in case of Imazethapyr +Imazamox it was 56 and 58% in NRC 130 and NRC 86 respectively. *Cyperus rotundus* was comparatively less affected weeds. Paraquat killed all the weeds in both the varieties except *Cyperus rotundus*. In case of Glyphosate application in both the varieties *Cyperus rotundus* survived more than other weeds in both the varieties. (Table 2)

**Seed yield (q/ha)**

There was no significant difference between the two varieties for seed yield. In which NRC 130 had a higher Seed yield, while NRC 86 had a low Seed yield. There was no significant difference was observed in Seed yield in all the treatments. In variety NRC 130 had higher Seed yield 11.84 q/ha in control and 10.33 q/ha in Imazethapyr + Imazamox treatment. There was no significant difference was observed in Seed yield in the treatment. In variety NRC 86 had higher Seed yield 9.07 q/ha in control and 8.06 q/ha in paraquat dichloride treatment. There is no effect of treatment among the varieties but difference may found among the varieties. (Table 3)

**100 Seed Index (g)**

There was no significant difference between the two varieties for seed index. In which NRC 130 had a higher Seed index, while NRC 86 had a low Seed index. In variety NRC 130 had higher seed index of 13.5 g in glyphosate treatment and 13.2 g in control. In variety NRC 86 had higher seed index of 9.8 g in treatment glyphosate and 9.7 g in control. There was no effect of treatment on seed index among the varieties. (Table 3)

**Effect of herbicides on seed qualities**

**Seed physical appearance**

The weed plants in seed production plots cause problem in seed crop harvesting. The weed plants contain higher moisture than mature soybean crop. Weed plants are also uprooted during harvesting and soil particles are mixed with seeds. The same situation was observed during harvesting of other seed crops of NRC 130 and NRC 86. It was observed that while harvesting weed plants in control plots were mixed with matured soybean plants and also several uprooted weed plants. In this experiment to create similar situation of combine harvesting, soybean seed crops of treatment and control plots were immediately threshed in threshing machine. The impact of weed plants on seed quality was observed as presence of greenish seeds and seeds with soil on surface. This situation was negligible in treated plots as compared to control plots. The physical appearance was poor due to loss of shine on seeds due to green weed plant juice and mud on seed surface.

**Seed Germination Test**

**Germination test after** **15 days of harvesting**

Herbicides are chemical that can have detrimental effect on soybean seed germination. The seed germination was tested immediately after harvest to check effect on seed germination. There was significant difference between the two varieties for seed germination. In which NRC 130 had a higher Seed germination, while NRC 86 had a low seed germination.

There was no significant difference observed in seed germination among the treatments and control in NRC 130, but treatments were significantly higher than control in variety NRC 130. In NRC 130 the germination among the control and treatment ranged from 82% in control to 88% in glyphosate treatment. There was Significant difference observed in seed germination in all the treatments, in variety NRC 86 had higher seed germination of 83 % in odyssey treatment and 69 % in control. (Table 4)

**Vigour index I**

There was no significant difference between the two varieties for vigour index I, in which NRC 86 had a higher Vigour index I, while NRC 130 had a low Vigour index I. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 130 had higher Vigour index I of 1861.9 in odyssey treatment and 1810.12 in control. There was no Significant difference observed in Vigour index I, in all the treatments in variety NRC 86 had higher Vigour index I of 1949.67 in odyssey treatment and 1621.5 in control. There was no effect of treatment on Vigour Index I in variety NRC 130 and NRC 86. (Table 5)

**Vigour index** **II**

There was significant difference between the two varieties for vigour index II, in which NRC 130 had a higher Vigour index II, while NRC 86 had a low Vigour index II. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 130 had higher Vigour index II of 139.74 in glyphosate treatment and 130.73 in control. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 86 had higher Vigour index II of 98.94 in paraquat treatment and 72.86 in control. There was effect of treatment on Vigour Index II in variety NRC 130 and NRC 86. (Table 5)

**Germination test after 30 days of harvesting**

There was significant difference between the two varieties for seed germination, in which NRC 130 had a higher Seed germination, while NRC 86 had a low seed germination.

There was no significant difference observed in seed germination among the treatments and control in NRC 130, but treatments were significantly higher than control in variety NRC 130. In NRC 130 the germination among the control and treatment ranged from 88% in paraquat treatment to 92% in odyssey. There was Significant difference observed in seed germination in all the treatments, in variety NRC 86 had higher seed germination of 77.5 % in odyssey treatment and 61 % in control. (Table 4)

**Vigour index I**

There was no significant difference between the two varieties for vigour index I, in which NRC 130 had a higher Vigour index I, while NRC 86 had a low Vigour index I. There was Significant difference observed in Vigour index I in all the treatments, in variety NRC 130 had higher Vigour index I of 1984.4 in odyssey treatment and 1493.1 in control. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 86 had higher Vigour index I of 1732.3 in paraquat treatment and 1288.2 in control. There was no effect of treatment on Vigour Index I in variety NRC 130 and NRC 86. (Table 5)

**Vigour index II**

There was significant difference between the two varieties for vigour index II, in which NRC 130 had a higher Vigour index II, while NRC 86 had a low Vigour index II. There was no Significant difference observed in Vigour index II in all the treatments, in variety NRC 130 had higher Vigour index II of 163.62 in control and 160.82 in odyssey treatment. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 86 had higher Vigour index II of 88.49 in glyphosate treatment and 68.14 in control. There was effect of treatment on Vigour Index II in variety NRC 130 and NRC 86 and difference may see in varieties. (Table 5)

**Germination test after 45 days of harvesting**

There was no significant difference between the two varieties for seed germination, in which NRC 130 had a higher Seed germination, while NRC 86 had a low seed germination. There was no significant difference observed in seed germination among the treatments and control in NRC 130, but treatments were significantly higher than control in variety NRC 130. In NRC 130 the germination among the control and treatment ranged from 87.5 % in glyphosate treatment to 92.5 % in paraquat. There was Significant difference observed in seed germination in all the treatments, in variety NRC 86 had higher seed germination of 76 % in paraquat dichloride treatment and 64.5 % in control. (Table 4)

**Vigour index I**

There was significant difference between the two varieties for vigour index I, in which NRC 130 had a higher Vigour index I, while NRC 86 had a low Vigour index I. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 130 had higher Vigour index I of 2538.3 in odyssey treatment and 2212.4 in control. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 86 had higher Vigour index I of 1923 in glyphosate treatment and 1611.21in control. There was no effect of treatment on Vigour Index I in variety NRC 130 and NRC 86. (Table 5)

**Vigour index II**

There was significant difference between the two varieties for vigour index II, in which NRC 130 had a higher Vigour index II, while NRC 86 had a low Vigour index II. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 130 had higher Vigour index II of 172.98 in paraquat treatment and 141.14 in control. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 86 had higher Vigour index II of 98.94 in glyphosate treatment and 83.21 in control. There was effect of treatment on Vigour Index II in variety NRC 130 and NRC 86. (Table 5)

**Accelerated Ageing Germination test**

**Germination test after 3 days of seeds 40o C in BOD**

There was significant difference between the two varieties for seed germination, in which NRC 130 had a higher Seed germination, while NRC 86 had a low seed germination.

There was no significant difference observed in seed germination among the treatments and control in NRC 130, but control were significantly higher than treatment in variety NRC 130. In NRC 130 the germination among the control and treatment ranged from 87% in odyssey treatment and 90.5% in control. There was no Significant difference observed in seed germination in all the treatments, in variety NRC 86 had higher seed germination of 79.5 % in paraquat treatment and 76.5 % in control. (Table 6)

**Vigour index I**

There was significant difference between the two varieties for vigour index I, in which NRC 130 had a higher Vigour index I, while NRC 86 had a low Vigour index I. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 130 had higher Vigour index I of 2225.4 in odyssey treatment and 2094.1 in control. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 86 had higher Vigour index I of 2307 in paraquat treatment and 1977.5 in control. There was no effect of treatment on Vigour Index I in variety NRC 130 and NRC 86. (Table 7)

**Vigour index II**

There was significant difference between the two varieties for vigour index II, in which NRC 130 had a higher Vigour index II, while NRC 86 had a low Vigour index II. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 130 had higher Vigour index II of 345.35 in control and 271.08 in glyphosate treatment. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 86 had higher Vigour index II of 179.75 in paraquat treatment and 152.16 in control. There was no effect of treatment on Vigour Index II in variety NRC 130 and NRC 86. (Table 7)

**Germination test after 7 of seeds 40o Cin BOD**

There was significant difference between the two varieties for seed germination, in which NRC 130 had a higher Seed germination, while NRC 86 had a low seed germination. There was no significant difference observed in seed germination among the treatments and control in NRC 130, but treatments were significantly higher than control in variety NRC 130. In NRC 130 the germination among the control and treatment ranged from 88 % in control and 93.5 in glyphosate treatment. There was no Significant difference observed in seed germination in all the treatments, in variety NRC 86 had higher seed germination of 84.5 % in glyphosate treatment and 73.5 % in control. (Table 6)

**Vigour index I**

There was significant difference between the two varieties for vigour index I, in which NRC 130 had a higher Vigour index I, while NRC 86 had a low Vigour index I. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 130 had higher Vigour index I of 2313.19 in glyphosate treatment and 2127.8 in control. There was no Significant difference observed in Vigour index I in all the treatments, in variety NRC 86 had higher Vigour index I of 2234.9 in paraquat treatment and 2068.2 in control. There was no effect of treatment on Vigour Index I in variety NRC 130 and NRC 86. (Table 7)

**Vigour index II**

There was significant difference between the two varieties for vigour index II, in which NRC 130 had a higher Vigour index II, while NRC 86 had a low Vigour index II. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 130 had higher Vigour index II of 157.52 in control and 145.35 in paraquat treatment. There was Significant difference observed in Vigour index II in all the treatments, in variety NRC 86 had higher Vigour index II of 115.85 in glyphosate treatment and 100.99 in control. There was effect of treatment on Vigour Index II in variety NRC 130 and NRC 86. (Table 7)