**Integrated weed management in *summer* sesame (*sesumunindicum L.*)**


## Abstract

A field research was evaluated at the Seed Technology, S. DAgricultural University, Sardarkrushinagar-385506, Banaskantha (North Gujarat) in the year between*summer* 2019 to 2021 to study the effect of weed management practices in summer sesamum.Experimental plot was loamysand in texture with low organic carbon and available N, medium in available $P_2O_5$ and high in available $K_2O$.

Treatments wereweed free (IC fb HW at 20 and 40 DAS), weedy control, pendimethalin 30 EC 0.750 kg/ha PE application fb IC+HW at 30 DAS, pendimethalin 30 EC1.0 kg/ha PE application fb IC+HW at 30 DAS, oxadiargyl 6 EC 75 g/ha PE fb IC + HW at 30 DAS, oxadiargyl 6 EC 90 g / ha PE fb IC+HW at 30 DAS, quizalofop-ethyl 5 EC 40 g/ha PoE 20 DAS fb IC+ HW at 40 DAS,quizalofop-ethyl 5 EC 50 g/ha PoE at 20 DAS fb IC+ HW at 40 DAS, pendimethalin 30 EC 0.75 kg/ha PE fbquizalofo-pethyl 5 EC 40 g/ha at 30 DAS and pendimethalin 30 EC 1.0 kg/ha PE fbquizalofop-ethyl 5EC 40 g/ha at 30 DAS.

The results revealed that significantly maximum seed yield (0.90 t/ha),stalk yield (2.14 t/ha), number of capsules per plant (73.1) and number of branches per plant (5.2) were obtained under weed free (IC fb HW at 20 and 40 DAS) treatment with maximum net realization (₹ 52322/ha).

Minimum weed density at harvest/m2and weed dry weight/m2 (67.17/m2 and 32.51g/m2) andmaximum weed control efficiency (71.62%) were found underweed free (IC fb HW at 20 and 40 DAS).



**Keywords:** Day after sowing (DAS), Sesame,Weedy control efficiency, Weed index


## Introduction

"Oilseeds are one of the most important for agricultural economy of India since long and considered as the second largest agricultural commodity in India after cereals" (DoA, 2011). "Edible oils and oil meals play vital role in solving the problem of malnutrition and securing the calorie nutrition for whole animal kingdom including human beings.Sesamum (*Sesamumindicum*L.) which is also popular as til, simsim, benised, gingelly, gergelim, *etc*.In India sesamecover in large area after groundnut.Oilseed are good source of energy and nutrition.All the crops of oilseeds occupy an area of 28.05 million hectareswith total production of 32.74 million tonnes and productivity 1168 kg/ha at national level in the year of 2013-14" (Anonymous, 2016a). "Only Sesamum recorded an area of 1.7 million hectare with the total production of 0.7 million tonnes and productivity of 426 kg ha-1 during 2013-14 among all the major oilseed crops" (Anonymous, 2016b). "In India the Gujarat

stands at 6.84 million tonnes production of oilseeds with first position. In Gujarat, Sesamum occupies an area of 2.36 lakh hectares in Gujarat with the total production of 2.21 lakh tonnes and productivity of 513 kg ha-1 during 2013-14" (Anonymous, 2016b).Amreli, Mahesana, Sabarkantha, Banaskantha, , Kheda, Surendranagar,Junagadh and Bhavnagar districts arecovered largestin sesame cultivated area in Gujarat

"Especially, At the early stage of crop high infestation of weedsgrowth poses considerable risk in achieving the low yield of crop. Maximum weed competition in this crop between 15 to 45 DAS" (Duary, B. and Hazra, D., 2013). Inter -culturing and hand weeding are very effective for weed control the weed infestation but always associated with regeneration of weeds which require frequent cultural operations which are not only sometime costly, but also always not feasible due to physical conditions of the soil. In initial stage of weed growth the chemical control of weed is very to be effective and economical. However, herbicides make a unfit for full of weeds control because of their selectivity. Due to lake of information regarding on sesame cultivation in North Gujarat, a research was frame out.

**Material and methods**

In order to evaluate the effect of different weed managementpractices on growth and yield attributes, yield, economics and quality of summersesame.An experiment was formulatedDuring summer 2019-20 to 2020-2021 at the Seed TechnologyDepartmnet, S. D Agricultural University, Sardarkrushinagar-385506, Banaskantha (North Gujarat)to pursue the management of weed in *summer* sesame (*sesumunindicum L*.). The experimental site of soil was loamy-sand in texture with EC of 0.11 dS/m and pH 7.61. The soil was low in available N (136.56 kg/ha), OC (0.31%), medium in available potassium (253.02 kg/ha) andmedium in available phosphorus (43.41 kg/ha).Experiment laid outin complete randomizedblock design (RBD) three replicationsand12 treatments. Treatments were weed free (Inter-Culturing*fb* Hand weeding at 20 and 40 DAS), weedy control, pendimethalin 30 EC 0.750 kg/ha Pre emergence application *fb* IC+HW at 30 DAS, pendimethalin 30 EC 1.0 kg/ha Pre emergence application *fb* IC+HW at 30 DAS, oxadiargyl 6 EC 75 g/ha Post emergence*fb* IC + HW at 30 DAS, oxadiargyl 6 EC 90 g/ha PE *fb* IC+HW at 30 DAS, quizalofop-ethyl 5 EC 40 g/ha Post emergence 20 DAS *fb* IC+ HW at 40 DAS, quizalofop-ethyl 5 EC 50 g/ha Post emergence at 20 DAS *fb* IC+ HW at 40 DAS, pendimethalin 30 EC 0.75 kg/ha Pre emergence*fb*quizalofo-pethyl 5 EC 40 g/ha at 30 DAS, pendimethalin 30 EC 1.0 kg/ha Pre emergence*fb*quizalofop-ethyl 5EC 40 g/ha at 30 DAS, oxadiargyl6 EC 75 g/ha Pre emergence*fb*quizalofopethyl 40 g/ha at 30 DAS and Oxadiargyl 6 EC 90 g/ha Pre emergence*fb*quizalofopethyl 40 g/ha at 30 DAS. The research was carried out in randomized block designed with 3 replications. 'GT 3'variety was sown in 45m apart with using 2.5 kg/ha seed rate and sown 15$^{th}$ February, 2020 and 24 February 2021 with application of recommended fertilizer dose of 50 kg/ha N and 25 kg/ha $P_2O_5$. Full dose of phosphorus and 1/3 of nitrogen was applied as basal in the form of DAP and Urea and remain two dose of nitrogen was applied in equal split at 30 and 5 days after sowing of crop.Before the sowing

sesame seedwas treated with thiram&captan@ 3.0 g per kg seed to protect the crop against fungaldiseases.End of May and first week of June the crop was harvested in 2019-2021 respectively. On economics basisAll the weed management treatments wascalculated considering the weeding cost of each treatment over weedy check and gross return was worked out on the basis ofprevailing market price of sesame.Pesticide residue analysis done by Modified QuECHERS LCMS method.This method increased availability of a number of pesticides and lack of knowledge about the proper dosage to apply for the crop leads to residues not only attaching the surface of leaves. Therefore, the extraction method efficiency should be high for real samples than the examining spiked sample extraction. From the literature review, it was found that QuEChERS sample preparation method suitable for analysis of pesticide residues in different crops and vegetable. The original QuEChERS method was modified for different analytes in various food samples. QuEChERS method is required to optimize for specific sample analyte in order to reduce errors as well as to increase the extraction efficiency. Normally, the solvent selection plays an important role in a sample preparation, based on nature of pesticides. Some solvents can be nominated as the extraction solvents namely ethyl acetate, acetone and acetonitrile24 for optimization. Among these solvents acetonitrile solvent has extra advantages such as less interference from proteins, lipids, and co extracted matrix, therefore achieves high recovery efficiency. In view of the stated advantages, MeCN was selected as the extraction solvent in the QuEChERS method. In this extraction method, MgSO4 and NaCl salts were used for better partitioning the layers and upper layer had given significant volume which was explored for high recoveries.

**Results and discussion**

The weed flora identified in our experiment was Digitariasanguinalis,TrianthemaportulacastrumCyperusrotundus,Tribulusterrestris,Digeraarvensis,Physalisminima, Tridexprocembus and Cynodondactylon.

**Effect of weed management treatment on crop growth**

Significant variation ofgrowth and yield attributing parameters due to different weed treatments (Table 1). Plant height (30 DAS & At harvest), number of branch/plant,capsules per plant and were recorded under the $T_1$ (Inter-Culturing*fb* Hand weeding at 20 and 40 DAS), however pendimethalin 30 EC 0.750 kg/ha Pre emergence application *fb* IC+HW at 30 DAS, pendimethalin 30 EC 1.0 kg/ha Pre emergence application *fb* IC+HW at 30 DAS was remained at par with $T_1$.Whereas, weedy control registered significantly the lowest values of growth and yield attributes. During critical period for growth and developmentSuppressed the weeds by application of herbicide and removal of weeds periodically by hand weeding and inter-culturing by weeding and interculturing, which in enhance the crop growth and make available weed free environment to the crop. These results corroborate the findings ofMathukiya*et al* (2015).

Plant stand during season was succeeding greengram crop,herbicidal study was reported satisfactoryin all plots. No phytotoxic effect due to any of the herbicidal treatment on succeeding greengram was observed (Table 1). Persistence of the herbicides was found BDL.

**Effect of weed management treatment on crop yield**

Seed yield of sesame significantly reported during individual years and in pooled results(Table 1). Seed yield of (895, 920 and 907 kg/ha) with $T_1$weed free (Inter-Culturing*fb* Hand weeding at 20 and 40 DAS)yielded significantly the highest during 2020, 2021 and in pooled results, respectively followed byapplication of pendimethalin 0.750 kg/ha Pre-emergenceapplication *fb* IC+ HW at 30 DAS,pendimethalin 1.0 kg/ha Pre-emergence application *fb* IC+ HW at 30 DAS,quizalofopethyl 40 g/ha Post-emergence 20 DAS *fb* IC+HW at 40 DAS and quizalofop ethyl 50 g/ ha post-emergence at 20 DAS *fb* IC+ HW at 40 DAS.Whereasunweededcontrol was observed Significantly the lowest seed yield (331, 494 and 441 kg/ha) the during both the individual years as well as in pooled result, respectively.Treatments $T_1$, $T_3$& $T_4$yield was increased over the control was emphasized of 104, 81 and 74 per cent, respectively.

Stalk yield foundSignificantly the highest (2102, 2177 and 2140 kg/ha) was under $T_1$weed free (Inter-Culturing*fb* Hand weeding at 20 and 40 DAS)in 2020, 2021 & in pooled results, respectively, followed by application of pendimethalin 0.750 kg/ha Pre-emergence application *fb* IC+ HW at 30 DAS,pendimethalin 1.0 kg/ha Pre-emergence application *fb* IC+ HW at 30 DAS,quizalofopethyl 40 g/ha Post-emergence 20 DAS *fb* IC+HW at 40 DAS and quizalofop ethyl 50 g/ ha post-emergence at 20 DAS *fb* IC+ HW at 40 DAS. Due to under this treatment Seed yield and stalk yield were reflected in increased through efficient control of weeds and improved growth and yield attributes. Whereas, significantly the lowest stalk yield of (891, 1138 and 1091 kg/ha) was foundunder the weedy control in individual years as well as in pooled results, respectively. These results are findings of Gnanavel and Anbhazhagan (2006) and Mathukiya*et al*. (2015)

**Effect on weed**

Effect on dry weight of weeds during 2020, 2021 in pooled results (Table 3) showed significant in different weed management treatment. Significantly reduced dry weight of weeds in weed-free treatment over the weedy control during individual years as well as in pooled results, the $T_1$weed free (Inter-Culturing*fb* Hand weeding at 20 and 40 DAS)treatment recorded significantly the lowest weed dry weight (34.91, 30.10 and 32.50 $g/m^2$)followed 1.0 kg/ha pendimethalinas a pre emergenceapplication *fb* IC+ HW at 30 DAS andapplication of pendimethalin 0.750 kg/ha as a pre emergence*fb* IC+ HW at 30 DAS. Whereas, the dry weight of weeds recorded highest in weedy control (118.60,110.17 and114.38 g/m2).

Inter-Culturing*fb* Hand weeding at 20 and 40 DAS showed that significantly the lowest weed density (67 per $m^2$) pooled over three years(Table 3), which was statistically at par with by pendimethalin 1.0 kg/ha PE application *fb* IC+ HW at 30 DAS (80 per $m^2$) and followed bypendimethalin 0.750 kg/ha PE application *fb* IC+ HW at 30 DAS (82 per $m^2$) and quizalofop ethyl 50 g/ha PoE at 20 DAS fb IC+ HW at 40 DAS (87 per $m^2$). Where in, (210 per $m^2$)weed populationmeans density of weed significantly the highest was showedunder the weedy control($T_2$). (Table-2) showed that theinter-Culturingand hand weeding at 20 and 40 DAS estimated highest weed control efficiency (70.62 %) and lowest in weed index (WI), followed by of application of1.0 kg/ha pendimethalin as pre emergence*fb* IC+ HW at 30 DAS and50 g/ha quizalofop ethyl as post emergence at 20 DAS *fb* IC+ HW at 40 DASrecorded WCE of 60.43 and 61.35%, withweed indexrecorded11.51 and 14.32 %, respectively.Sukhadia*et al*(2004) and Gnanavel and Anbhazhagan (2006).

**Economics**

Maximum net returns of ₹ 52,322/ha recorded under the treatment ofInter-Culturing*fb* Hand weeding at 20 and 40 DAS ($T_1$) followed by pendimethalin 30 EC 1.0 kg/ha pre emergence application *fb* IC+ HW at 30 DAS, pendimethalin 30 EC 0.750 kg/ha pre emergence application *fb* IC+ HW at 30 DAS, which gave net return of ₹ 44,420/ha and ₹ 42,432/ha, respectively. Weed-free (IC *fb* HW at 20 and 40 DAS) reordered the maximum B:C ratio of 1.72, followed by pendimethalin 1.0 kg/ha PE application fb IC+ HW at 30 DAS, pendimethalin 0.750 kg/ha PE application fb IC+ HW at 30 DAS by recording B:C ratio of 1.54 and 1.49, respectively (Table 2). Mathukiya*et al*. (2015)

**Conclusion**

It was Concluded that effective control of weeds in summer sesame along with higher yield could be achieved by weed-free (IC fb HW at 20 and 40 DAS) as and when required or application of pendimethalin 30EC 1.0 kg/ha PE application *fb* IC+ HW at 30 DAS, pendimethalin 30EC 0.750 kg/ha PE application *fb* IC+ HW at 30 DAS under North Gujarat agro-climatic conditions of Gujarat.

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**Table 1. Effect of integrated weed management on growth and yield attribute of sesame**

| Treatments | Dose g/ha | Plant height (cm) | | Branch /plant | Capsule /plant | Plant stand at 15 DAS/metre row length | Phyto-toxicity rating (0 to 10 scale) | Residue analysis (2021) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAS | At harvest | | | | | pendi | oxy | quiz |
| Weed free (IC *fb*HW at 20 and 40 DAS) | - | 26.97 | 102.83 | 5.2 | 73.1 | 11.08 | 0.0 | BDL | BDL | ND |
| Weedy control | - | 20.26 | 74.17 | 3.2 | 37.8 | 10.68 | 0.0 | BDL | BDL | ND |
| Pendimethalin + IC and HW at 30 DAS | 750 | 24.89 | 97.50 | 4.8 | 68.0 | 10.72 | 0.0 | BDL | - | - |
| Pendimethalin + IC and HW at 30 DAS | 1000 | 24.25 | 99.67 | 4.8 | 70.5 | 11.50 | 0.0 | BDL | - | - |
| Oxadiargyl+ IC and HW at 30 DAS | 75 | 24.32 | 77.83 | 4.3 | 51.7 | 10.82 | 0.0 | - | BDL | - |
| Oxadiargyl + IC and HW at 30 DAS | 90 | 25.23 | 81.63 | 4.3 | 54.8 | 9.88 | 0.0 | - | BDL | - |
| Quizalofopethyl + IC and HW at 40 DAS | 40 | 19.96 | 92.27 | 4.6 | 63.9 | 10.53 | 0.0 | - | BDL | - |
| Quizalofop ethyl + IC and HW at 40 DAS | 50 | 19.77 | 94.96 | 4.7 | 66.4 | 10.90 | 0.0 | - | BDL | - |
| Pendimethalin + quizalofopethyl at 30 DAS | 0.75+40 | 23.37 | 81.73 | 4.5 | 54.1 | 10.07 | 0.0 | BDL | BDL | ND |
| Pendimethalin + quizalofopethyl at 30 DAS | 1000+40 | 25.46 | 84.09 | 4.6 | 55.4 | 9.93 | 0.0 | BDL | BDL | ND |
| Oxadiargyl +quizalofopethyl at 30 DAS | 75+40 | 24.69 | 76.33 | 4.2 | 49.1 | 10.26 | 0.0 | BDL | BDL | ND |
| Oxadiargyl +quizalofopethyl at 30 DAS | 90+40 | 24.81 | 76.27 | 4.0 | 49.0 | 9.90 | 0.0 | BDL | BDL | ND |
| SEm± | | 0.72 | 2.56 | 0.12 | 2.19 | 0.24 | 0.0 | | | |
| C.D. at 5% | | 2.07 | 7.28 | 0.33 | 6.23 | NS | 0.0 | | | |

*Pendimethalin, Oxadiargyl, Quizalofopethyl, Day after sowing (DAS)

**Table 2. Effect of integrated weed management on yield and economic of sesame**

| Treatments | Dose g/ha | Seed yield kg/ha | | | Stalk yield (kg/ha) | | | Net return (₹ /ha) | B:C |
|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2021 | pooled | 2020 | 2021 | pooled | | |
| Weed free (IC *fb*HW at 20 and 40 DAS) | - | 895 | 920 | 907 | 2102 | 2177 | 2140 | 52322 | 1.72 |
| Weedy control | - | 391 | 494 | 443 | 891 | 1138 | 1014 | 17998 | 0.80 |
| Pendimethalin + IC and HW at 30 DAS | 750 | 706 | 849 | 777 | 1654 | 1969 | 1811 | 42432 | 1.49 |
| Pendimethalin + IC and HW at 30 DAS | 1000 | 726 | 880 | 803 | 1724 | 1993 | 1858 | 44420 | 1.54 |
| Oxadiargyl+ IC and HW at 30 DAS | 75 | 538 | 664 | 601 | 1223 | 1431 | 1327 | 26022 | 0.91 |
| Oxadiargyl + IC and HW at 30 DAS | 90 | 567 | 682 | 625 | 1284 | 1544 | 1414 | 27934 | 0.96 |
| Quizalofopethyl + IC and HW at 40 DAS | 40 | 624 | 821 | 723 | 1429 | 1908 | 1668 | 37243 | 1.30 |
| Quizalofop ethyl + IC and HW at 40 DAS | 50 | 683 | 833 | 758 | 1546 | 1843 | 1695 | 40163 | 1.39 |
| Pendimethalin + quizalofopethyl at 30 DAS | 0.75+40 | 567 | 651 | 610 | 1336 | 1533 | 1434 | 29829 | 1.16 |
| Pendimethalin + quizalofopethyl at 30 DAS | 1000+40 | 572 | 639. | 606 | 1417 | 1278 | 1347 | 29051 | 1.11 |
| Oxadiargyl +quizalofopethyl at 30 DAS | 75+40 | 508 | 602 | 555 | 1132 | 1326 | 1229 | 24450 | 0.94 |
| Oxadiargyl +quizalofopethyl at 30 DAS | 90+40 | 506 | 625 | 566 | 1223 | 1508 | 1366 | 25217 | 0.95 |
| SEm± | | 42 | 45 | 29 | 128 | 120 | 76 | - | - |
| C.D. at 5% | | 124 | 133 | 83 | 389 | 364 | 217 | - | - |

Day after sowing (DAS)

**Table 3. Effect of integrated weed management on weed parameters, weed control efficiency and weed index**

| Treatments | Dose g/ha | Weed density/$m^2$ | | | Weed dry weight at harvest g/$m^2$ | | | WCE (%) | WI (%) |
|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2021 | pooled | 2020 | 2021 | pooled | | |
| Weed free (IC *fb*HW at 20 and 40 DAS) | - | 8.47$^{f}$ (71.33) | 7.96$^{d}$ (63.00) | 8.21$^{g}$ (67.17) | 5.95$^{e}$ (34.91) | 5.51$^{e}$ (30.10) | 5.73$^{f}$ (32.51) | 71.62 | 00 |
| Weedy control | - | 15.06$^{a}$ (225.33) | 14.01$^{a}$ (196.00) | 14.50$^{a}$ (210.67) | 10.89$^{a}$ (118.60) | 10.51$^{a}$ (110.17) | 10.70$^{a}$ (114.38) | 00 | 51.23 |
| Pendimethalin + IC and HW at 30 DAS | 750 | 9.47$^{ef}$ (89.33) | 8.75$^{cd}$ (76.33) | 9.11$^{f}$ (82.83) | 7.03$^{d}$ (49.29) | 6.47$^{d}$ (41.55) | 6.75$^{e}$ (45.42) | 60.43 | 14.32 |
| Pendimethalin + IC and HW at 30 DAS | 1000 | 9.18$^{ef}$ (84.33) | 8.71$^{cd}$ (75.67) | 8.94$^{fg}$ (80.00) | 7.02$^{d}$ (48.82) | 6.40$^{d}$ (40.54) | 6.71$^{e}$ (44.68) | 61.16 | 11.51 |
| Oxadiargyl+ IC and HW at 30 DAS | 75 | 12.11$^{bc}$ (147.00) | 10.89$^{b}$ (118.33) | 11.50$^{bc}$ (132.67) | 8.88$^{bc}$ (78.70) | 7.95$^{c}$ (62.78) | 8.41$^{cd}$ (70.74) | 38.33 | 33.80 |
| Oxadiargyl + IC and HW at 30 DAS | 90 | 11.63$^{bc}$ (135.00) | 10.97$^{b}$ (120.00) | 11.30$^{c}$ (127.50) | 8.78$^{c}$ (76.70) | 7.94$^{c}$ (62.56) | 8.36$^{cd}$ (69.63) | 39.27 | 31.18 |
| Quizalofopethyl + IC and HW at 40 DAS | 40 | 10.02$^{de}$ (100.00) | 9.19$^{c}$ (84.67) | 9.61$^{def}$ (92.33) | 7.06$^{d}$ (49.43) | 6.98$^{d}$ (48.50) | 7.02$^{e}$ (48.97) | 57.15 | 20.37 |
| Quizalofop ethyl + IC and HW at 40 DAS | 50 | 9.75$^{ef}$ (95.33) | 8.94$^{cd}$ (79.67) | 9.35$^{ef}$ (87.50) | 6.92$^{d}$ (47.50) | 6.43$^{d}$ (41.03) | 6.67$^{e}$ (44.27) | 61.35 | 16.44 |
| Pendimethalin + quizalofopethyl at 30 DAS | 0.75+40 | 11.33$^{cd}$ (128.00) | 9.58$^{c}$ (92.33) | 10.45$^{d}$ (110.17) | 8.55)$^{c}$ (72.73) | 8.05$^{c}$ (64.75) | 8.30$^{d}$ (68.74) | 39.96 | 32.84 |
| Pendimethalin + quizalofopethyl at 30 DAS | 1000+40 | 11.25$^{cd}$ (126.33) | 8.93$^{cd}$ (79.33) | 10.09$^{de}$ (102.83) | 8.49$^{c}$ (71.78) | 8.17$^{bc}$ (66.83) | 8.33$^{d}$ (69.31) | 39.41 | 33.26 |
| Oxadiargyl +quizalofopethyl at 30 DAS | 75+40 | 12.95$^{b}$ (168.00) | 11.45$^{b}$ (131.00) | 12.20$^{b}$ (149.50) | 9.68$^{b}$ (93.20) | 8.94$^{b}$ (79.65) | 9.31$^{b}$ (86.43) | 24.56 | 38.81 |
| Oxadiargyl +quizalofopethyl at 30 DAS | 90+40 | 12.29$^{bc}$ (151.67) | 11.12$^{b}$ (123.33) | 11.70$^{bc}$ (137.50) | 9.10$^{bc}$ (82.79) | 8.71$^{bc}$ (75.43) | 8.90$^{bc}$ (79.11) | 30.86 | 37.67 |
| SEm± | | 0.46 | 0.33 | 0.28 | 0.28 | 0.26 | 0.178 | - | - |
| C.D. at 5% | | 1.34 | 0.98 | 0.80 | 0.81 | 0.76 | 0.50 | - | - |

*Figures in the parenthesis are original values.  All Figures are square root($\sqrt{x + 0.5}$) transformed values , Day after sowing (DAS)