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Research Article

# Response of Durum Wheat Varieties and Weeding Frequency on Weed Infestation, Yield and Yield Component of Wheat

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## Abstract
Wheat (*Triticum* spp.) becomes one of the most important cereal crops in the highland of Ethiopia ranking 2nd in total grain production next to maize. However, weed competition is one of the most important production constraints causing up to 65% reduction in potential yield of wheat. Therefore, this study was conducted in 2018 and 2019 consecutive main cropping season at North Gondar zone, Ethiopia to determine the effect of durum wheat varieties and weeding frequency on weeds, yield and yield components of wheat. The field experiment was comprised 15 treatment combination with two improved durum wheat varieties (namely Mangudo and Utuba) and one local and five weeding frequency (one hand weeding at 20DAE, one hand weeding at 30DAE, two hand weeding at 20 and 50DAE, weed free check and weedy check). The treatment was laid out in Randomized Complete Block Design (RCBD) in a factorial arrangement and replicates three times per treatment. Among both study area, durum wheat varieties and weed frequencies significantly affected weed density, weed dry biomass, weed control efficiency and all yield and yield component parameters. The interaction effect of Mangudo improved durum wheat variety with weed free check treatments reduce the weed density, weed dry biomass and having a good weed control efficiency performance by 22.78%, 3.89% and 84.06% respectively as compared to other treatment combination. However, they didn't showed significance difference between Utuba improved durum wheat varieties with weed free check treatments. The highest thousand grain weight of 48.66 g and 47.55g were obtained from Mangudo and Utuba improved durum wheat varieties with weed free check treatments, respectively. Significantly maximum grain yield of 39.57q ha$^{-1}$ and 38.88 q ha$^{-1}$ were also recorded from Mangudo and Utuba improved durum wheat varieties with complete weed free treatments, respectively while the minimum grain yield of 21.67q was recorded from local wheat with weedy check treatments. It could be conclude that cultivating Mangudo and Utuba improved durum wheat varieties with complete weed free treatments were resulted in optimum growth parameter and yield of wheat as compared to other treatments.

**Keywords:** *Triticum* spp., wheat, cropping season, randomized complete block design, weed control.

## Introduction
Wheat is one of the major cereal crops in Ethiopian highlands (Gebre-Mariam, 1991; Khaliq *et al.*, 2013). In Ethiopia, durum wheat accounts for 40% of production, and bread wheat the remaining 60% (Anteneh and Asrat, 2020). Durum wheat is an indigenous predominant wheat species (Kabbaj *et al.*, 2017). It produced a wide range of soil conditions, although it is best adapted to fertile, well drained and clay loam soils at altitude range 1500 to 2800 masl (Hailu *et al.*, 2015). The crop plays a significance role in the national economy and thus, currently increasing the production and productivity of this crop is central in the strategic plan to attain sustainable grain production and food self-sufficiency (Teklu and Hammer, 2009). The mean average yield of durum wheat on farmers field still below 2.5t/ha and the yield is often lower than that obtained other durum wheat producing countries (Geleta and Grausgruber, 2013). The major reason for this low productivity of durum wheat are wide use of unimproved local cultivar, declining soil fertility, poor traditional cultural practice, insect pests, disease and problematic weeds (Lemma, 2019). Among pests, weeds infestation is the main bottleneck in crop production in Ethiopia, especially during the rainy season (Mansingh *et al.*, 2017). Weeds competes wheat crop for nutrients, water, sunlight, space and weaken the main crop, which ultimately lead to low crop yield. Weeds decrease the wheat yield by 15-70% and in serious cases the loss may lead complete failure of the crop (Fahad *et al.*, 2015; Hussain *et al.*, 2017). Generally there is a negative linear relationship between weed biomass and wheat crop yield, so weed suppression is translated directly in to yield (Kristensen *et al.*, 2008). The climate encourages rapid and abundant growth of weeds and consequently, all agricultural crops are heavily infested with weeds.

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Farmers in the country are aware of weed problem in their fields but often they cannot cope-up with heavy weed infestation during the peak-period of agricultural activities because of labor shortage, hence, most of their fields are weeded late or left un-weeded. Such ineffective weed management is considered as the main factor for low average yield of wheat resulting in average annual yield loss of 35% (Bekele *et al.*, 2006). Among cultural weed control methods, hand weeding and hoeing can reduce weed emergence up to 80 %, resulting in a 69 % increase in wheat yield compared to standard seed bed preparation (Ologbon and Yusuf, 2012). Adopting hand weeding methods of weed control can be an effective and economic weed control strategy and the basis for a cost-effective, eco-friendly and sustainable weed management program (Thomas *et al.*, 2011). However; there have been limited research efforts that assessed weeding frequency in wheat crop production in the study areas. Thus, this study was conducted to evaluate the effect of durum wheat variety and frequency of weeding on weeds, growth, yield attributes and yield of wheat.

## Materials and methods

***Description of the study area:*** The study was conducted in two selected wheat producing districts of the former North Gondar zone such as Debark and Wogera districts during 2018 and 2019 consecutive cropping seasons. North Gondar zone is found in Amhara Region, north-western Ethiopia, located at latitudes from 120 39'66" to 120 42'45"N, and longitudes from 370 26'99" and 370 28'42"E. With an estimated area of 45, 944.6 km2 , altitude in this zone ranges from 500 m a.s.l. in the lowlands of Adiarkay districts to about 3000 m a.s.l. in the Semen Mountain national park.
The District is located on the western slopes of the Semen Mountains in the North Gondar Administrative Zone of Amhara Regional State, northwestern Ethiopia. In terms of climatic conditions, the districts represents an agro ecological zone described as 'cool, moist mid-highlands' (MoARD, 2005). The rainfall in the districts is characterized by a bi-modal rainfall distribution pattern with the long rainy season extends from June to Mid- September accounts for about 65% of the annual rainfall whereas the short rainy season extends from March to May and constitutes about 15% of the annual rainfall with annual average amount ranges from 600 to 1200 mm per year (Ayalew *et al.*, 2012; Abebaw and Betru, 2019). Average monthly temperatures range between nighttime lows of 2.3°C in December and daytime highs of 23.6°C in April. According to the meteorological data the mean annual temperature ranges from 12.9°C to 26.4°C (Hijmans *et al.*, 2015; Lemann *et al.*, 2017). Soils within the study area are dominated by Nitosols (55%), Leptosols (30%), Cambisols (10%) and Vertisols (6%) (Hurni *et al.*, 2015).

According to the most recent national census, 87% of the population lives in rural areas of the district and the remaining 13% live within town. The agricultural landscape surrounding the study area is typical of the northern Ethiopian highlands, characterized by rolling hills and river valleys used for mixed crop and livestock production. Most land is devoted to rain fed annual field crops, including cereals, legumes, and oilseeds. In irrigated areas along rivers and in gardens close to homesteads, farming families plant additional grains, as well as root and vegetable crops (Zerfu, 2014).

***Experimental design and treatments:*** The treatments consisted of combination of three durum wheat varieties, namely, Utuba, Mangudo, and local, with hand-weeding 20 days after crop emergence (DAE), hand-weeding 30 days after crop emergence (DAE), two hand-weeding 20 and 50 days after crop emergence (DAE), weed free (WF) and weedy check (WC). Improved durum wheat varieties were released by Debrezit Agricultural Research Center and the local wheat was purchased from the local market. It was selected based on their wide scale production by the farmers and the potential of the varieties in the study area. The experiment was conducted using factorial arrangement in RCBD design with three replications. The gross plot size was 3.6 $m^2$ (1.2 m × 3.0 m), and the path between plots and blocks were 0.5 m and 1.5 m, respectively to facilitate movement to different plots for various operations and data recording. The treatments were assigned randomly and the seeds at rate of 100 kg $ha^{-1}$ were drilled in furrows manually. The seeds were planted at spacing of 20 cm between rows. Phosphorus through di-ammonium phosphate (DAP) and ½ N through DAP and urea was applied at the time of sowing while the remaining ½ N through urea was top dressed in two equal splits at tillering and panicle initiation stages. Hand-weeding and hoeing as per the treatment was done in the assigned plots at an appropriate time. The weeds in complete weed free plots were removed as and when emerged to keep the plots free from the weeds. All the recommended cultural practices were also applied in the field.

***Data collection:*** The weed population was counted just before first hand weeding or three weeks after crop emergence and about 15 days before the expected harvest time. The category wise (broadleaved, grass and sedges) population count was taken with the help of 1 m x 1 m quadrate thrown randomly at three places in each plot at joining. The weed dry mass was also recorded from the above thrown quadrants after cutting weeds from the ground level and oven dried at 70°c. Weed Control Efficiency (WCE) - It was calculated from weed control treatments in controlling weeds and using the following formula (Sharma *et al.*, 2018).

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$$\text{WCE (\%)} = \frac{DMWut - DMWt}{DMWut} \times 100 \quad (1)$$

Where, WCE = Weed control efficiency, WDC = Dry matter of weed from un-treated plots or weedy check plots and DMWt = Dry matter of weed from treated plots or plots in particular treatment

***Growth parameters, yield and yield components:*** Plant height (cm) was taken with a meter from ten randomly selected and pre tagged plants in each net plot area from the base to the apex of the main stem at physiological maturity. The spike length was recorded in centimeters starting from the base to the end of the spike, but not including awns, of five randomly selected spikes and the average was calculated. Thousand seeds were counted and their weight (g) was recorded and adjusted at 12.5% moisture content. The grain yield (q $ha^{-1}$) was measured after threshing the sun dried plants harvested from each net plot.

***Relative yield loss (%):*** The loss in seed yield was determined as a percentage of the difference between weeded plots (complete weed free) and yield in a particular treatment using the formula;

$$\text{RYL} = \frac{Y1 - Y2}{Y1} \times 100 \quad (2)$$

Where, RYL = Relative Yield loss, Y1 = Yield which is obtained from complete weed free plots, Y2 = Yield which is obtained in a particular treatment.

***Statistical analysis:*** Collected data were subjected to the analysis of variance appropriate to the design using SAS computer software package version 9.2 (Kim *et al.*, 2013). Mean separation tests were applied following the randomized complete block design procedure as described by Gomez and Gomez (1984) using Fisher's protected Least Significance Difference (LSD) values were used to separate differences among treatments means at 5% probability level.

## Results and discussion

***Weed flora:*** Many types of weed species has been found to infest the wheat crops. The existing weed species of the experimental area were *Avena fatua, Hypochoeris radicata, Polygonium nepalense, Galinsoga parviflora, Gallium spurium, Medicago polymorpha, Oxalis latifola, Spergula arvensis, Guizotia scabra, Galium hamatum* L., *Cynodon dactlylon, Cynodon nlemfuensis, Cyprus rotundas, Eleusine indica* L. Gaertn, *Phalaris paradoxa* L., *Spergula arvensis* L, *Tagetes minuta* L. *and Bidens pilosa*. Out of total weeds present in the experimental field 27.3% were broadleaved while 72.7% were grasses.

***Weed density ($m^{-2}$):*** Analysis of variance showed that the interaction effect of durum wheat varieties with weeding frequency had shown significant difference on weed control efficiency at $P<0.05$ (Table 1). The highest weed density of 56.78 $m^{-2}$ was obtained from local wheat with weedy check treatments, followed by 54.43 and 53.67$m^{-2}$ weed densities were recorded from Mangudo and Utuba improved durum wheat variety with weedy check plots, respectively while the lowest weed density of 22.78 and 24.34 $m^{-2}$ were recorded from Mangudo and Utuba improved varieties of wheat with weed free check experimental units.

***Weed dry biomass ($gm^{-2}$):*** The interaction effect of durum wheat varieties and weeding frequencies had shown significant difference on aboveground dry biomass at $P<0.05$ (Table 1). Significant variation in weed dry biomass existed between treatments (Table 1). The analyzed result revealed that at crop harvest there were high reductions in weed dry biomass of improved durum wheat varieties with weeding frequencies. The lowest (3.89, 4.01 and 4.64g $m^{-2}$) weed dry biomass were found to be from Mangudo, Utuba and local wheat with complete weed free check plots as compared to other treatments. On the other hand the highest weed dry biomass of 24.41$gm^{-2}$ was recorded from local wheat with weedy check plots, followed by 19.87 and 18.31$gm^{-2}$ weed dry biomass was recorded from Utuba and Mangudo improved durum wheat varieties with weed check treatments.

***Weed control efficiency (%):*** Analysis of variance showed that the interaction effect of durum wheat varieties with weeding frequencies had shown significant difference on weed control efficiency at $P<0.05$. The highest weed control efficiency (84.06%) was recorded from Mangudo improved durum wheat variety with complete weed free treatments, followed by (83.57% and 80.99%) which were obtained from Utuba improved durum wheat variety and local wheat integrated with weed free treatments, respectively whereas, the lowest (0.0%) weed control efficiency was recorded in local wheat with weedy check treatments (Table 1).

***Number of tiller per plant:*** Analysis of variance showed that the interaction effect of durum wheat with weeding frequencies had shown significant difference on productive tillers at $P<0.05$. The significantly higher number of total tillers were found in response of interaction of Mangudo and Utuba durum wheat with complete weed free plots which was obtained 4.33 and 4.08 total productive tillers, respectively while the lowest number of total productive tillers of 1.22 was observed in local wheat with weedy check or control plots, followed by Utuba durum wheat variety with weedy check or control plots which was obtained 1.33 productive tillers (Table 2).

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Table 1. Effects of durum wheat varieties and weeding frequency on total weed dry weight (g $m^{-2}$) and weed control efficiency (%).

| Durum wheat varieties | Weeding Frequency | Weed density ($m^{-2}$) | Weed Dry Biomass ($gm^{-2}$) | WCE (%) |
|---|---|---|---|---|
| Utuba | One hand weeding at 20DAE | $46.56^{d}$ | $13.03^{cd}$ | 46.59 |
| | One hand weeding at 30DAE | $40.45^{e}$ | $8.27^{fg}$ | 66.11 |
| | Two hand weeding at 20&50DAE | $33.01^{g}$ | $6.88^{gh}$ | 71.80 |
| | Weed free check | $24.34^{i}$ | $4.01^{i}$ | 83.57 |
| | Weedy check | $53.67^{b}$ | $19.87^{b}$ | 18.57 |
| Mangudo | One hand weeding at 20DAE | $47.68^{d}$ | $11.47^{de}$ | 52.99 |
| | One hand weeding at 30DAE | $40.94^{e}$ | $8.03^{g}$ | 67.09 |
| | Two hand weeding at 20&50DAE | $33.95^{g}$ | $6.33^{gh}$ | 74.06 |
| | Weed free check | $22.78^{i}$ | $3.89^{i}$ | 84.06 |
| | Weedy check | $54.43^{b}$ | $18.31^{b}$ | 24.99 |
| Local | One hand weeding at 20DAE | $50.34^{c}$ | $14.23^{c}$ | 41.68 |
| | One hand weeding at 30DAE | $42.46^{e}$ | $10.37^{ef}$ | 57.50 |
| | Two hand weeding at 20&50DAE | $36.45^{f}$ | $7.02^{g}$ | 71.23 |
| | Weed free check | $28.54^{h}$ | $4.64^{i}$ | 80.99 |
| | Weedy check | $56.76^{a}$ | $24.41^{a}$ | 0.00 |
| LSD (5%) | | 2.135 | 2.250 | |
| CV (%) | | 10.35 | 12.36 | |

*LSD* least significant difference at 5% level of significant, *CV* coefficient of variation in percent; *DAE* days after emergency; *WCE* weed control efficiency; Mean values in the same letter within a column are not showed significantly different at 5% probability.

Table 2. Effects of durum wheat varieties and weeding frequency on number of tiller per plant, plant height, number of spike per plant and spike length.

| Durum wheat varieties | Weeding Frequency | NTPP | PH (cm) | NSPP | SL(cm) |
|---|---|---|---|---|---|
| Utuba | One hand weeding at 20DAE | $2.07^{f}$ | $67.66^{gh}$ | $7.08^{f}$ | $6.62^{fgh}$ |
| | One hand weeding at 30DAE | $2.66^{d}$ | $69.88^{ef}$ | $8.97^{c}$ | $7.99^{cd}$ |
| | Two hand weeding at 20&50DAE | $3.33^{c}$ | $71.66^{de}$ | $10.09^{b}$ | $8.78^{bc}$ |
| | Weed free check | $4.08^{a}$ | $74.27^{b}$ | $10.63^{b}$ | $9.26^{ab}$ |
| | Weedy check | $1.33^{h}$ | $70.55^{e}$ | $6.33^{g}$ | $6.03^{hi}$ |
| Mangudo | One hand weeding at 20DAE | $2.42^{e}$ | $70.71^{e}$ | $8.66^{cd}$ | $7.08^{ef}$ |
| | One hand weeding at 30DAE | $2.86^{d}$ | $72.72^{cd}$ | $9.06^{c}$ | $8.22^{cd}$ |
| | Two hand weeding at 20&50DAE | $3.66^{b}$ | $73.83^{bc}$ | $11.26^{a}$ | $9.33^{ab}$ |
| | Weed free check | $4.33^{a}$ | $76.45^{a}$ | $11.76^{a}$ | $9.98^{a}$ |
| | Weedy check | $1.66^{g}$ | $74.54^{d}$ | $7.67^{e}$ | $6.26^{fgi}$ |
| Local | One hand weeding at 20DAE | $1.66^{g}$ | $64.72^{i}$ | $6.77^{fg}$ | $5.61^{i}$ |
| | One hand weeding at 30DAE | $2.33^{e}$ | $66.73^{h}$ | $7.66^{e}$ | $6.66^{fgh}$ |
| | Two hand weeding at 20&50DAE | $2.88^{d}$ | $68.86^{fg}$ | $8.33^{d}$ | $7.02^{fg}$ |
| | Weed free check | $3.23^{c}$ | $72.22^{d}$ | $8.76^{cd}$ | $7.87^{de}$ |
| | Weedy check | $1.22^{h}$ | $70.66^{e}$ | $6.23^{g}$ | $4.87^{i}$ |
| LSD (5%) | | 0.225 | 1.205 | 0.565 | 0.815 |
| CV (%) | | 8.68 | 11.45 | 9.85 | 9.06 |

*LSD* least significant difference at 5% level of significant, *CV* coefficient of variation in percent; *DAE* days after emergency; *NTPP* number of tiller per plant, *PH* plant height, *NSPP* number of spike per plant; *SL* spike length; Mean values in the same letter within a column are not showed significantly different at 5% probability.

The data showed that the number of total productive tillers highly depends on wheat varieties and weeding frequency. The difference in the number of tillers produced by the wheat varieties could be attributed to genetic difference (Sial, 2007). The higher total tiller per unit area from improved durum wheat varieties with weed free plots might be due to reduced intra plant competition as higher as the same seed rate was used which was further enhanced due to lack of weed competition as the plots were kept completely weed free plots.

The lowest number of productive tillers under all treatment with weedy checks/control plots was due to unavailability of more space for better light interception, reduced nutrients and moisture availability for the crop due to the presence of weeds. This finding was directly supported with the study of (Dalga *et al.*, 2014) who stated that weeds are naturally strong competitor and compete with crops for space, nutrient, moisture, light and carbon dioxides that they could reduce the yield components of the crop.

***Plant height (cm):*** Analysis of variance showed that the interaction effect of durum wheat varieties with weeding frequencies had shown significant difference on plant height at *P*<0.05 (Table 2). Effect of weed management practice on plant height among what varieties and weeding frequency practice was showed significance deference (Table 2). Among the interaction effects, the highest plant height of 76.45 cm was recorded from Mangudo durum wheat variety with complete weed free plots while the lowest plant height of 64.72 cm was obtained from local wheat with once time weeding at 20days after emergency (Table 2).

***Number of spike per plant:*** The highest number of spike per plant 11.76 and 11.26 was found the interaction of Mangudo durum wheat variety with complete weed free plots and the interaction of Mangudo durum wheat variety with twice hand-weeding at 20 and 50 DAE respectively. However, they did not show significant difference among them (Table 2). The lowest number of spike per plant of 6.23 was recorded from local wheat with weedy check plots, followed by 6.33 and 6.77 which recorded from Utuba durum wheat variety interact with weedy check/control plots and local wheat with once time weeding at 20DAE, respectively which they did not showed significant difference (Table 2). This was due to high infestation of weeds which were competed with the crop resulted in the lowest number of spike per plant along treatments. This result agrees with the findings of (Khaliq *et al.*, 2013) who reported that number of spike per plant was significantly reduced with the increase weed infestation. This finding also in line with Chauhan *et al.* (2012) and Chauhan *et al.* (2012) who stated that the removal of weeds from crop at critical time could boost the yield and yield components. Later hand weeding after critical period of weed control would not enhance yield and yield components but create conducive environment for harvesting. If weeds are well controlled during the critical period the crop will be so far advanced, and at the end of it new weed seedlings are no longer detrimental to the yield components of crop. Moreover, in complete weed free treatment, the number of spike were healthy completely filled as against shriveled and few grains in weedy check treatments.

***Spike length (cm):*** The analyzed data showed that weed control methods significantly increased the spike length of wheat (Table 2). The maximum spike length of 9.98 cm was measured from improved Mangudo durum wheat with weed free experimental plots, followed by 9.33 and 9.26 cm which was the integration of Mangudo improved durum wheat variety with twice weeding practice at 20 and 50DAE and Utuba durum wheat variety with weed free treatments, respectively. However, both of these weed control methods were statistically similar to each other but varied significantly from rest of the weed control methods (Table 2). The lowest spike length of 4.87cm was recorded in local wheat with weedy check experimental units, followed by 5.61, 6.03 and 6.22cm were recorded from local wheat with weed check, Utuba durum wheat with weed check, Mangudo improved durum wheat with weed check treatments. However these treatments did not showed statistically significant difference (Table 2). Spike length influenced the grains per spike and consequently affected the grains yield of the wheat crop.

***Thousand grain weight (g):*** Analysis of variance showed that thousand grain weights were significantly affected by durum wheat varieties, weed frequency and their interaction at *P*<0.05 (Table 3). Among the interaction effects, the highest thousand grain weight of 48.66 g was recorded from Mangudo durum wheat variety with complete weed free plots while the lowest thousand grain weight of 35.66 g was recorded from local wheat with weedy check plots, followed by local wheat with weedy check plots and Utuba durum wheat variety with weedy check plots which was recorded 38.08g and 38.44 g, respectively. However they didn't showed significance difference (Table 3). The plants raised under complete weed free environment were free from weed competition thus utilized the available resources to its maximum benefit resulting in increased grain weight. The more and vigorous leaves under weed free environment that improved the supply of assimilate to be stored in the grain, hence, the weight of 1000 grain weight increased.

***Grain yield (q ha$^{-1}$):*** The interaction effect of durum wheat varieties and weeding frequency had shown the significant difference on the grain yield at *P<0.05* (Table 3). The highest grain yield of 39.57q ha$^{-1}$ and 38.88 q ha$^{-1}$ were recorded in Mangudo and Utuba durum wheat varieties with complete weed free plots, respectively while the lowest grain yield of 21.67q ha$^{-1}$ was obtained from local wheat with complete weedy check/control plot, which were significantly lower than all other treatments (Table 3). Hand weeding might have also contributed to higher yield compared to weedy checks. Besides the highest grain yields which were recorded in plots weeded completely, the interaction of wheat varieties with weeding frequency at different weeks after crop emergence were showed significant difference. These results indicated that weeding at different crop and weed stage with interaction of varieties had great influence on the grain yield. Besides the highest grain yields which were recorded in completely weed free plots, the interaction of improved durum wheat varieties interact with weeding frequency at different weeks after crop emergence were showed significant difference.

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Table 3. Effects of durum wheat varieties and weeding frequency on thousand grain weights, grain yield and relative grain yield loss.

| Durum wheat varieties | Weeding Frequency | TGW (g plot$^{-1}$) | GY (qha$^{-1}$) | RGYL (%) |
|---|---|---|---|---|
| Utuba | One hand weeding at 20DAE | 43.03$^{e}$ | 30.33$^{g}$ | 23.35 |
| | One hand weeding at 30DAE | 43.87$^{de}$ | 32.06$^{f}$ | 18.97 |
| | Two hand weeding at 20&50DAE | 45.66$^{c}$ | 36.33$^{c}$ | 8.19 |
| | Weed free check | 47.55$^{ab}$ | 38.88$^{ab}$ | 1.74 |
| | Weedy check | 38.44$^{g}$ | 26.65$^{hi}$ | 32.65 |
| Mangudo | One hand weeding at 20DAE | 43.22$^{de}$ | 32.25$^{f}$ | 18.49 |
| | One hand weeding at 30DAE | 45.67$^{c}$ | 34.06$^{de}$ | 13.92 |
| | Two hand weeding at 20&50DAE | 47.04$^{b}$ | 37.66$^{bc}$ | 4.83 |
| | Weed free check | 48.66$^{a}$ | 39.57$^{a}$ | 0.00 |
| | Weedy check | 40.05$^{f}$ | 28.04$^{h}$ | 29.14 |
| Local | One hand weeding at 20DAE | 38.08$^{g}$ | 25.68$^{i}$ | 35.11 |
| | One hand weeding at 30DAE | 40.88$^{f}$ | 28.08$^{h}$ | 29.04 |
| | Two hand weeding at 20&50DAE | 43.66$^{de}$ | 32.66$^{ef}$ | 17.46 |
| | Weed free check | 44.33$^{d}$ | 34.44$^{d}$ | 12.96 |
| | Weedy check | 35.66$^{h}$ | 21.67$^{j}$ | 45.24 |
| LSD (5%) | | 1.125 | 1.535 | |
| CV (%) | | 12.06 | 14.06 | |

*LSD* least significant difference at 5% level of significant, *CV* coefficient of variation in percent; *DAE* days after emergency; *TGW* thousand grain weights, *GY* grain yield; *RGYL* relative grain yield loss; Mean values in the same letter within a column are not showed significantly different at 5% probability.

These results indicated that weeding at different crop and weed stage with interaction of improved varieties had great influence on the grain yield. Further; the plots treated by two times weeding at 20 and 50days after emergency with improved varieties were showed significant over one time weeding at 20 and 40 days after emergency (Table 3). This data revealed that removing weeds from crop fields twice could reduce weed competition and contributed higher grain yield than weeded once time.

***Relative grain yield loss (%):*** Among two way interaction effects, the maximum relative grain yield loss of 45.24% and 35.11% were obtained from local wheat with weedy check/control plots and local wheat with once time weeding at 20 days after emergency, respectively while the minimum relative grain yield loss was obtained from Mangudo durum wheat variety with weed free check which result of insignificance loss, followed by Utuba durum wheat variety with weed free check/control plots and Mangudo durum wheat variety with twice weeding at 20 and 50 days after emergency, which result of 1.74% and 4.83%, respectively (Table 3).

## Conclusion

The result of this study clearly indicated that the interaction of durum wheat varieties and weeding frequency resulted in significantly better crop yield than untreated check. Specially, the interaction of improved durum wheat varieties with weed free plots and weeding has been carried out at 20 and 50 DAE was in significantly higher yields as compared to local wheat with weedy check plots and also local wheat with one weeding practice during 20 DAE.

In general, weeding frequency with improved durum wheat varieties were more effective on total weed density reduction and lower dry matter weight accumulation as compared to local wheat with weeding frequency. It may conclude that the integration of improved durum wheat varieties and weeding frequency were proven to be economically and ecologically safe weed management strategies. The integration significantly reduced weed density, weed dry biomass and ultimately increase the yield of wheat. However, because of the agro ecology and seasonal variation, further research is necessary in order to provide more accurate recommendation.

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## References

1. Abebaw, S. and Betru, T. 2019. A review on status and determinants of household food security in Ethiopia. Ethiop. *J. Environ. Stud. Managmnt*. 12(10): 3-11.
2. Anteneh, A. and Asrat, D. 2020. Wheat production and marketing in Ethiopia: Review study. *Cogent Food Agricult.* 7(6): 78-893.
3. Ayalew, D., Tesfaye, K., Mamo, G., Yitaferu, B. and Bayu, W. 2012. Variability of rainfall and its current trend in Amhara region, Ethiopia. *Afri. J. Agricult. Res.* 8(7): 1475-1486.
4. Bekele, E., Azerefegne, F. and Abate, T. 2006. Facilitating the implementation and adoption of integrated pest management (IPM) in Ethiopia. Planning workshop from October.

*Corresponding author

5. Chauhan, B.S., Singh, R.G. and Mahajan, G. 2012. Ecology and management of weeds under conservation agriculture: a review. *Crop Protect.* 38(42): 57-65.
6. Dalga, D., Sharma, J. and Tana, T. 2014. Growth and yield of bread wheat (*Triticum aestivum* L.) as influenced by row spacing and weeding frequency in Southern Ethiopia. *Scientia.* 8(6):19-30.
7. Fahad, S., Hussain, S., Chauhan, B.S., Saud, S., Wu, C., Hassan, S., Tanveer, M., Jan, A. and Huang, J. 2015. Weed growth and crop yield loss in wheat as influenced by row spacing and weed emergence times. *Crop Protect.* 71(68): 101-108.
8. Gebre-Mariam, H. 1991. Wheat production and research in Ethiopia. Wheat research in Ethiopia: A historical perspective, 4(2) 1-16.
9. Geleta, N. and Grausgruber, H. 2013. On-farm diversity and genetic erosion of tetraploid wheat landraces in Ambo and Dandi Districts, West Shewa, Ethiopia. *Sci. Technol. Arts Res. J.* 3(2): 1-9.
10. Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural research. John Wiley & Sons.13(7): 81-89.
11. Hailu, H., Mamo, T., Keskinen, R., Karltun, E., Gebrekidan, H. and Bekele, T. 2015. Soil fertility status and wheat nutrient content in Vertisol cropping systems of central highlands of Ethiopia. *Agricult. Food Secur.* 4(6): 1-10.
12. Hijmans, R.J., Cameron, S., Parra, J., Jones, P., Jarvis, A. and Richardson, K. 2015. WorldClim-Global Climate Data. Free Climate Data for Ecological Modeling and GIS 5(7):11-19.
13. Hurni, K., Zeleke, G., Kassie, M., Tegegne, B., Kassawmar, T., Teferi, E., Moges, A., Tadesse, D., Ahmed, M. and Degu, Y. 2015. Economics of Land Degradation (ELD) Ethiopia case study: Soil degradation and sustainable land management in the rainfed agricultural areas of Ethiopia: An assessment of the economic implications. Water and Land Resource Centre (WLRC); Centre for Development 3(5): 17-28.
14. Hussain, S., Khaliq, A., Bajwa, A., Matloob, A., Areeb, A., Ashraf, U., Hafeez, A. and Imran, M. 2017. Crop growth and yield losses in wheat due to little seed canary grass infestation differ with weed densities and changes in environment. *Planta Daninha.* 35(31):11-21.
15. Kabbaj, H., Sall, A.T., Al-Abdallat, A., Geleta, M., Amri, A., Filali-Maltouf, A., Belkadi, B., Ortiz, R. and Bassi, F.M. 2017. Genetic diversity within a global panel of durum wheat (*Triticum durum*) landraces and modern germplasm reveals the history of alleles exchange. *Front. Pl. Sci.* 8(10): 1277-1289.
16. Khaliq, A., Shakeel, M., Matloob, A., Hussain, S., Tanveer, A. and Murtaza, G. 2013. Influence of tillage and weed control practices on growth and yield of wheat. *Philippine J. Crop Sci.* 38(42): 100-109.
17. Kim, Y., Choi, Y.K. and Emery, S. 2013. Logistic regression with multiple random effects: a simulation study of estimation methods and statistical packages. *Amer. Stat.* 67(72): 171-182.
18. Kristensen, L., Olsen, J. and Weiner, J. 2008. Crop density, sowing pattern, and nitrogen fertilization effects on weed suppression and yield in spring wheat. *Weed Sci.* 56(51): 97-102.
19. Lemann, T., Roth, V. and Zeleke, G. 2017. Impact of precipitation and temperature changes on hydrological responses of small-scale catchments in the Ethiopian Highlands. *Hydrolog. Sci. J.* 62(54): 270-282.
20. MoARD, J. 2005. Community Based Participatory Watershed Development: Addis Ababa University. Ethiopia.
21. Ologbon, O. and Yusuf, S. 2012. Economics of weed control practices on rice farms in Obafemi-Owode area of Ogun State, Nigeria. *J. Agricult. Biol. Sci.* 7(2): 503-508.
22. Paul Mansingh, J., Velmurugan, L., Shenkuta, D. and Bayissa, D.D. 2017. Pests and disease diagnostic mobile tool "m-wheat" for wheat crop in ethiopia. *J. Agricult. Inform.* 8: 44-54.
23. Sharma, K., Parmar, P., Solanki, K. and Singh, U. 2018. Weed control efficiency, productivity and energy relationships of wheat (*Triticum aestivum* L.) production as influenced by herbicidal weed control in vertisols of central India. *J. Pharmacog. Phytochem.* 7(3): 3715-3720.
24. Sial, M. 2007. Genetic heritability for grain yield and its related characters in spring wheat (*Triticum aestivum* L.). *Pak. J. Bot.* 39(32): 1503-1509.
25. Teklu, Y. and Hammer, K. 2009. Diversity of Ethiopian tetraploid wheat germplasm: breeding opportunities for improving grain yield potential and quality traits. *Pl. Genetic Resour.* 7(4): 1-8.
26. Thomas, A., Legere, A., Leeson, J., Stevenson, F., Holm, F. and Gradin, B. 2011. Weed community response to contrasting integrated weed management systems for cool dryland annual crops. *Weed Res.* 51(37): 41-50.
27. Lemma, A. 2019. Genetic erosion, drought tolerance and genotype by environment interaction of durum wheat (*Triticum turgidum* var durum) in Ethiopia. Haramaya University.
28. Zerfu, T. 2014. Genotypes X Environment Interaction of Yield and Yield Related Traits in Sweet Potato [*Ipomoea Batatas* (L.) Lam.) Varieties in Southern Nations Nationalities and Peoples' Region (Snnpr), Ethiopia. Haramaya University.

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