



## **The role of flag leaf blade and awns on yield and its components of some bread wheat varieties at two locations of sulaimani region**

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Article info	Abstract
<p>Original: 24 May. 2015            Revised: 18 August. 2015            Accepted: 30 August. 2015            Published online: 20 March. 2016</p> <p><b>Key Words:</b>  <i>Wheat varieties, Seeding rates, and removal treatments.</i></p>	<p>This investigation was conducted during the growing season of 2009-2010, at two different locations (Qlyasan Agriculture Research Station, College of Agricultural sciences- University of Sulaimani, and farm land in Dukan), using split-split plots design in RCBD with four replications. Four common wheat varieties of different origins (Araz, Tamuz, Rabea'a, and Cham-4) were used grown and implemented in the main plots. Four seeding rates of (120, 160, 200, and 240) kg/ ha implemented in the sub-plots as the second factor, while four leaf and awn removal treatments as the third factor were implemented in the sub-sub plots that were (control, flag leaf blade removal, awns removal, and flag leaf blade + awns removal).</p> <p>Grain yield with some of its components were measured such as number of spikes/ m<sup>2</sup>, spike weight/ m<sup>2</sup>, spike length, number of spikelets/ spike, number of grain/ spike, grain weight/ spike, 1000- grain weight, and grain yield). Data on biological yield and harvest index were also recorded.</p> <p>The results of grain yield and its components with biological yield, and harvest index can be summarized as the average of both locations as follows: the effect of varieties on these characteristics was highly significant, Araz variety showed maximum values for the characteristics: number of spikes/ m<sup>2</sup>, spike weight/ m<sup>2</sup>, average spike length, and harvest index. Tamuz variety exhibited maximum number of spikelets/ spike, and grain number/ spike, while Rabea'a variety showed maximum values for the characteristics: grains weight/ spike, 1000- grains weight, grain yield, and biological yield. However, Tamuz variety produced minimum values for the characteristics; spike weight/ m<sup>2</sup>, grain weight/ spike, 1000- grains weight, grain yield, biological yield, and harvest index. The effect of seeding rates on yield characteristics and its components as the average of both locations was highly significant on number of spike / m<sup>2</sup>, spike weight/ m<sup>2</sup>, grain yield, and biological yield only, using the seed rate of 240 kg/ ha exhibited maximum values for these characteristics, while 120 kg/ ha seeding rate showed minimum values in number of spikes / m<sup>2</sup>, grain yield, and biological yield.</p> <p>Regarding the effect of removal treatments on yield characteristics, and its components as the average of both locations, the characteristics, number of spikes/ m<sup>2</sup>, spike weight/ m<sup>2</sup>, grain weight/ spike, 1000- grains weight, grain yield, and biological yield highly significant responded to these effects. While the characteristics number of spikelets/ spike, significantly responded, and the characteristics average spike length, number of grains/ spike, and harvest index showed no significant respons. The control treatments produced maximum values of yield and its components, while removing both flag leaf blade + awn showed minimum values in spike weight/ m<sup>2</sup>, grains weight/ spike, 1000- grains weight, and grain yield.</p>

## **Introduction**

The world need of wheat production is predicted to be 760 million tons of wheat for each year for 2020 [1]. This amount is 27% more than the global production in 1997, and indicates that demand for wheat will increase by 1.3% for each year worldwide and by more than 1.5% per year in developing countries [2]. The recorded world wheat production was 688 million tons in 2008-2009, marking a 13% rise more than over the previous year and Australia, and UK based trade body were the most world wheat producer [3]. The global production of wheat was 673.9 million tons in 2009, whereas global industrialized at 646 million tons, they prediction was to rise from 2.5 million tons to 26.5 million in USDA Canada's. Therefore, it was still 2 million under than wheat produced in 2008/09 [4].

Wheat yield is the complex trait, depending on genetic and environmental factors and their interaction. In fact yield is a resultant of value of yield components as well: height of plant, number of productive tillers, number of spikelets/ spike, number of grain/ spike, grain mass/ spike, number of spikes/ m<sup>2</sup>, thousand grain mass and others. The favourable environmental factors such as water, temperature and fertilizer, pesticide application play necessary roles in wheat yield rising [5 and 6]. The private and public sectors have a greater choice from new cultivars, often with little relevant information available on their achievement in the local environment [7]. There is no consistent correlation between seed rate and yield due to variation in achievement. Although, there is a strong relation between spring plant population and crop achievement [8]. The 'optimum' plant population (at maximum grain yield) varied more 30- 220 plants/ m<sup>2</sup>, based on season and cultivar. In common, variation in the 'optimum' population was higher between seasons for a given cultivar than between cultivars within seasons [9 and 10]. In wheat the leaves particularly flag leaves have been considered to be the key organs providing to higher yields, while awns have been considered subsidiary organs. In contrast, with extensive investigations on the assimilation contribution of leaves, the photosynthetic characteristics of awns have not been well studied [11]. Contribution to the yield of cereals has traditionally been studied using yield and different yield components, thus neglecting the role of other organs such as ear awns and flag leaf. Recently, the most important is to study the effects of genotypes on the photosynthetic activity of the flag leaf blade and the ear awns of spring wheat. The parameters associated with the photosynthetic activity were examined about the grain yield and different yield components at maturity [12]. The effect of awns and 5 top leaf blades on grain yield of wheat grown under various environments were determined. Yield was increased in the awned crops than in the awn clipped crops under all environment conditions. Flag leaf made the greatest contribution to yield. The contribution of the lower blades reduce in the descending order, decrease was the extended in the normal-sown crop [13].

Along with flag leaf the awn is essential to grain filling and yield in cereals. In the study, they used techniques to the function of the awn in grain development included a comparison of lines differing in awnless [14].

The goal of this study was to evaluate the role of flag leaf and awns of some bread wheat varieties, different plant populations (seeding rates), locations, and participation of flag leaf, and awns on yield and its components.

## **Materials and Methods**

This investigation was conducted during winter seasons of 2009-2010 at two locations, first; Qlyasan Agriculture Research Station, College of Agricultural sciences- University of Sulaimani, 2 km northwestern of Sulaimani city (35° 34' 307" N and 45° 21' 992" E with an altitude of 765 masl), and second; farmland of Dukan, 70 km northern of Sulaimani (35° 48' 651" N and 45° 06' 020" E with an altitude of 747 masl), using split split-plot design with four replicates [15]. To study four common wheat varieties of different origins as source of these information:

No.	Varieties	Pedigree		Origin
1	Araz	(Sonara 64 × Lerma Rojo 64) × Senta Elena		Mexico
2	Tamuz	(Saberbeg × Mexipak × Abu-Greb4)	(by radiation)	Iraq
3	Rabea'a	(Saberbeg × Indian wheat GDU-831)		Iraq
4	Cham-4	Attila - 3.Mynaa"ul / Turaco / 3 / Turaco.kauz // Kauz / Star.Kauz / Gen		ICARDA

Grains of all cultivars have been obtained from Bakrajo Research Center in Sulaimani, which implemented in the main plots, conducted with Randomized Completely Block Design (RCBD), the second factor was seeding rates four (120, 160, 200, and 240) Kg/ ha implemented in the sub-plots, and the third factor was leaf and awn treatments, implemented in the sub-sub-plots, which were control; (Flag leaf removal, Awns removal, and flag leaf blade + Awns removal). Each sub sub-plot consisted of eight rows, 2 m long, and 0.25 m apart within rows.

The dates of drilling were November 11<sup>th</sup>, and 13<sup>th</sup>, 2009 for both locations Qlyasan, and farmland of Dukan, respectively.

The meteorological data shown for both locations in (Table 1). The representative soil samples were taken from both fields before tillage at (0-30) cm depth, these samples were air dried then sieved using 2mm sieves, then packed for analysis. Some physical and chemical properties were analyzed at the Department of soil and water sciences, College of Agriculture, University of Sulaimani (Table 2)

The data were statistically analyzed according to the methods of analyses of variance as a general test, and combined analysis of variance across locations was conducted. All possible comparisons among the means were carried out using L. S. D. test (Least Significant Difference) at a significant level of 5 % whenever significant they show their significant differences [16].

Table 1 : The meteorological data of both locations:

<i><b>Qlyasan (2009-2010)</b></i>							
<i>Months</i>	<i>Air temperature °C</i>			<i>RH %</i>	<i>Precipitation</i>	<i>Wind</i>	<i>ETo (mm)</i>
	<i>avg.</i>	<i>max.</i>	<i>Min.</i>				
<i>Oct.</i>	22.5	28.9	16.1	38.0	72.9	0.9	4.2
<i>Nov.</i>	13.2	17.5	8.8	69.0	136.4	0.7	2.4
<i>Dec.</i>	9.9	13.4	6.3	76.0	98.3	0.5	1.3
<i>Jan.</i>	10.3	14.3	6.3	69.0	69.0	0.7	1.7
<i>Feb.</i>	10.3	14.4	6.1	69.0	161.9	0.8	1.6
<i>Mar.</i>	14.8	19.5	10.0	58.0	93.2	1.5	2.5
<i>Apr.</i>	17.5	22.6	12.4	62.0	77.1	1.0	3.5
<i>May</i>	23.0	28.7	17.6	46.0	80.8	1.1	6.0
<i>Jun.</i>	31.0	37.0	25.2	26.0	0.0	1.5	9.3

**Dukan (2009-2010)**

Months	Air temperature °C			RH %	Precipitation		Wind		ET <sub>o</sub> (mm)	Soil temperature °C 50cm	Cloud Cover oktas
	avg.	max.	Min.		Depth (mm)	Speed m/s	Direction				
Oct.	23.8	31.0	17.6	33.3	28.8	2.2	110.5	4.0	27.2	4.3	
Nov.	14.5	19.1	10.9	63.4	66.8	3.1	128.7	2.2	18.8	5.6	
Dec.	10.2	13.7	7.5	73.7	139.6	2.5	111.4	1.1	13.1	5.4	
Jan.	10.4	14.1	7.5	69.3	54.6	3.6	106.2	1.4	12.1	5.2	
Feb.	10.3	14.2	6.8	71.0	83.4	2.8	107.8	1.7	11.6	5.5	
Mar.	14.8	19.6	10.1	61.7	108.4	3.7	95.1	2.8	14.6	4.9	
Apr.	17.5	23.8	12.5	64.6	43.0	2.88	120.9	3.2	18.3	4.8	
May	24.3	31.7	17.9	43.5	29.4	2.9	124.0	5.6	28.0	4.4	
Jun.	32.7	41.0	25.4	20.9	0.2	3.3	122.0	9.3	31.6	2.7	

\* Total precipitation = (789.6, and 554) for Qlyasan, and Dukan, respectively.

\* Total ET<sub>o</sub> = (32.5, and 31.3) for Qlyasan, and Dukan, respectively

**Table 2: Physical & chemical properties of soil in both locations:**

Soil Properties	Qlyasan	Dukan	
<i>P. S. D.</i>	Silty loam	Clay loam	
<i>Sand ( gm.Kg<sup>-1</sup> )</i>	116.3	303.1	
<i>Silt ( gm.Kg<sup>-1</sup> )</i>	648.9	409.7	
<i>Clay ( gm.Kg<sup>-1</sup> )</i>	243.8	287.2	
<i>EC or E.C. ( dS.m<sup>-1</sup> )</i>	0.41	0.37	
<i>pH</i>	7.63	7.39	
<i>O.M. ( gm.Kg<sup>-1</sup> )</i>	19.18	18.17	
<i>Total N ( gm.Kg<sup>-1</sup> )</i>	1.02	1.51	
<i>Available Phosphorous ( mg.Kg<sup>-1</sup> ) Soil</i>	4.49	2.89	
<i>CaCO<sub>3</sub> ( gm.Kg<sup>-1</sup> )</i>	27.35	103.2	
<i>Soluble Cations &amp; Anions mmole L<sup>-1</sup></i>	<i>Ca<sup>++</sup></i>	1.62	1.32
	<i>K<sup>+</sup></i>	0.39	0.13
	<i>Na<sup>+</sup></i>	0.44	0.52

$CO_3^{2-}$	0.00	0.00
$HCO_3^{2-}$	2.88	2.25
$Cl$	0.45	0.11
$SO_4^{2-}$	0.81	<b>0.63</b>

These analyses were carried out at Soil and Water Science Department, College of Agriculture, University of Sulaimani.

#### Studied Characteristics:

##### Yield and its components:

- 1- No. of spikes/ m<sup>2</sup>: The mean number of spikes/ m<sup>2</sup>.
- 2- Spike weight/ m<sup>2</sup>: The mean spike weight/ m<sup>2</sup>.
- 3- Average spike length (cm): The mean length of ten spikes (cm).
- 4- No. of spikelets/ Spike: The mean of number of spikelets for ten spikes.
- 5- No. of grains/ Spike: The mean number of grains for ten spikes.
- 6- Grains weight/ spike (g): The mean grains weight for ten spikes.
- 7- 1000- Grain weight (g): The mean of 1000- grain weight for three samples for each treatment.
- 8- Grain yield (ton/ ha): One (m<sup>2</sup>) was harvested for each treatment then converted to grain yield/ hectare.
- 9- Biological yield (ton/ ha): The means (total vegetative biomass+ total economical organ yield) by g/ m<sup>2</sup> then converted to ton/ ha.
- 10- Harvest index (H.I.): Measured by separating the grains from straw yield and weighed to calculate the H.I. according to the following equation [17]:

$$H.I\% = \frac{\text{Grain yield}}{\text{biomass yield}} \times 100$$

## Results and Discussion

Table (3) show the response of yield and its components to variety effect in both locations of Qlyasan, Dukan, and their average. At both locations, and their average varieties studied significantly produced the grain yield and its components with the exception of harvest index non significantly responded to varieties in the first location. Maximum grain and biological yield obtained in particular varieties may be due to the highest value of yield components such as number of tillers/ m<sup>2</sup>, and number of spikes/ m<sup>2</sup> [18, 19, 20 and 21].

Improved grain yield is the ultimate aim of cereal breeders. Yield increase may be effectively tackled on the basis of the performance of yield components and other closely associated characteristics [22], and some other workers confirmed these results [23 and 24].

Table -3: Means of yield and its components of wheat varieties:

Varieties	No. of spikes / m <sup>2</sup>	Spike weight / m <sup>2</sup> (g)	Average spike length (cm)	No. of spikelets / spike	No. of grains / spike	Grains weight / spike (g)	1000 - Grains weight (g)	Grain yield (ton/ ha)	Biological yield (ton/ ha)	Harvest Index (H.I.)
<b>Qlyasan Location</b>										
<i>Araz</i>	390.500	676.676	10.235	18.258	44.172	1.773	43.184	4.628	16.501	0.280
<i>Tamuz</i>	320.813	511.412	9.723	19.109	55.906	1.787	34.559	3.567	13.079	0.275
<i>Rabea'a</i>	326.000	627.588	9.498	17.188	45.711	2.024	46.975	4.493	16.912	0.277
<i>Cham-4</i>	286.688	570.644	8.955	18.602	45.898	1.622	37.459	3.960	13.923	0.296
<b>L.S.D (p ≤ 0.05)</b>	20.794	93.051	0.380	0.495	2.730	0.245	2.065	0.570	2.393	n.s
<b>Dukan Location</b>										
<i>Araz</i>	577.125	801.629	10.936	17.859	43.289	1.215	41.275	4.587	22.619	0.201
<i>Tamuz</i>	559.125	579.424	10.749	19.094	55.836	0.930	33.256	2.246	21.795	0.100
<i>Rabea'a</i>	512.813	801.617	10.334	18.109	50.875	1.769	44.925	4.859	27.116	0.176
<i>Cham-4</i>	474.875	741.085	10.252	18.867	55.770	1.256	36.044	3.590	21.889	0.167
<b>L.S.D (p ≤ 0.05)</b>	43.496	46.508	0.273	0.785	2.344	0.168	1.479	0.396	0.676	0.007
<b>Average of both locations</b>										
<i>Araz</i>	483.813	739.152	10.586	18.059	43.730	1.494	42.230	4.607	19.560	0.240
<i>Tamuz</i>	439.969	545.418	10.236	19.102	55.871	1.359	33.907	2.907	17.437	0.188
<i>Rabea'a</i>	419.406	714.603	9.916	17.648	48.293	1.897	45.950	4.676	22.014	0.226
<i>Cham-4</i>	380.781	655.864	9.604	18.734	50.834	1.439	36.751	3.775	17.906	0.231
<b>L.S.D (p ≤ 0.05)</b>	22.387	48.306	0.217	0.431	1.671	0.138	1.179	0.322	1.155	0.013

Table (4) show the effect of seeding rates on the yield and yield components in both locations average. It was noticed that this effect was non significantly for all characters with the exception of number of spikes/ m<sup>2</sup> , grain yield and biological yield which were only significant in the first location. While in the second location this table indicated the presence significant effect of seeding rates on all characters with the exception of average spike length, number of spikelets/spike, grains weight and 1000-grains weight non significantly responded to seeding rates. However, in the average of both location there were non significantly for all characters with the exception of number of spikes/ m<sup>2</sup>, spike weight/ m<sup>2</sup>, grain yield and biological yield that were significantly responded. Higher seeding rates generally increased dry matter production, especially in early grazing, during first 6 to 14 weeks after sowing. Higher seeding rates normally have no negative effect on grain yield or quality. It was suggested that Seeding rates from 100 to 120 kg/ ha (220 to 240 plants/ m<sup>2</sup>) for cold and higher rainfall areas, 90 kg/ ha (160 plants/ m<sup>2</sup>) for medium rainfall areas and milder environments, and 60 kg/ ha (120 plants/ m<sup>2</sup>) for lower rainfall warmer districts as a good seeding rates. That produced a good quality of seeds with a high germination percentage [25].

Also previously reported that no significant differences were observed in grain yield and most of its components as seeding rates increased from 120 kg/ ha to 180 kg/ ha [26 and 27].

If plant population falls below the economic, optimum yields fall significantly, especially if grass weed infestation is serious [8].

Table -4: The effect of seeding rates on mean yield and its components:

<i>Seeding Rates (Kg/ ha)</i>	<i>No. of spikes / m 2</i>	<i>Spike weight / m 2 ( g )</i>	<i>Average spike length ( cm )</i>	<i>No. of spikelets / spike</i>	<i>No. of grains / spike</i>	<i>Grains weight / spike ( g )</i>	<i>1000 - Grains weight ( g )</i>	<i>Grain yield (ton/ ha)</i>	<i>Biologic al yield (ton/ ha)</i>	<i>Harvest Index ( H.I. )</i>
<b><i>Olyasan Location</i></b>										
<i>120</i>	271.188	563.636	9.588	18.492	47.336	1.747	40.359	3.821	14.274	0.272
<i>160</i>	330.375	600.353	9.470	18.117	48.617	1.816	40.664	4.031	14.624	0.288
<i>200</i>	354.313	601.693	9.683	18.391	47.367	1.808	40.880	4.451	15.829	0.291
<i>240</i>	368.125	620.638	9.673	18.156	48.367	1.835	40.274	4.346	15.688	0.276
<b><i>L.S.D (p ≤ 0.05)</i></b>	<i>18.413</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>0.319</i>	<i>1.232</i>	<i>n.s</i>
<b><i>Dukan Location</i></b>										
<i>120</i>	499.688	736.568	10.770	18.469	52.871	1.244	38.790	3.791	22.259	0.167
<i>160</i>	540.250	689.401	10.410	18.367	48.953	1.274	39.069	3.919	23.273	0.170
<i>200</i>	531.188	749.406	10.641	18.883	51.922	1.286	38.955	3.564	23.428	0.149
<i>240</i>	552.813	748.379	10.449	18.211	52.023	1.366	38.686	4.008	24.460	0.159
<b><i>L.S.D (p ≤ 0.05)</i></b>	<i>18.241</i>	<i>28.875</i>	<i>n.s</i>	<i>n.s</i>	<i>2.685</i>	<i>n.s</i>	<i>n.s</i>	<i>0.273</i>	<i>0.913</i>	<i>0.013</i>
<b><i>Average of both locations</i></b>										
<i>120</i>	385.438	650.102	10.179	18.480	50.104	1.495	39.574	3.806	18.266	0.220
<i>160</i>	435.313	644.877	9.940	18.242	48.785	1.545	39.866	3.975	18.948	0.229
<i>200</i>	442.750	675.549	10.162	18.637	49.645	1.547	39.917	4.008	19.629	0.220
<i>240</i>	460.469	684.509	10.061	18.184	50.195	1.600	39.480	4.177	20.074	0.217
<b><i>L.S.D (p ≤ 0.05)</i></b>	<i>12.738</i>	<i>30.276</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>n.s</i>	<i>0.206</i>	<i>0.754</i>	<i>n.s</i>

Table (5) show the effect of removal treatments on grain yield and some of its components indicating the presence of significantly effect of removal treatments on all characteristics with the exception of number of grains/ spike in the first location, average spike length in the second location and the average spike length, number of grains/spike and harvest index on the average of both locations which were non- significantly to removal treatments.

The flag leaf blade is considered to be a primary source of assimilates for grain filling and grain yield due to its short distance to the spike and the fact that it stay green for longer than the rest of the leaves. Positive correlations have been found between flag leaf blade size and yield [28], while different parts of ear including awns photosynthesize and contribute to grain filling [29, 30 and 31] and it plays a key role in ear photosynthesis [32].

The removal of Flag leaf significantly reduced final grain weight, and maximum rate of grain filling of Italian, and Spanish varieties, but it had no effect on grain filling duration. Diminution in final grain weight due to flag leaf blade removal were larger in modern varieties than in old varieties, suggesting that the contribution of the flag leaf blade to grain filling increased over time. The most significant changes in flag leaf attributes of Italian varieties were recorded for chlorophyll content and leaf area duration (LAD), which increased 9.1%, and 3.8% respectively [33]. Furthermore, it has been indicated that the flag leaf removal at heading reduced the 1000- grain weight by 11.2% and increased the grain protein content by 1.70% [34]. The improved grain yield is the ultimate aim of cereal breeders. Yield increase may be effectively tackled on the basis of the performance of yield components and other closely associated characteristics [22]. The flag leaf, being the site of photosynthetic activity, appear to have an obvious relationship to the plant's grain yield ability. Compared to other leaves, the flag leaf contributes the most photosynthetic assimilates in wheat; therefore, it assumes the greatest importance in terms of grain yield [35]. It was suggested that awns play a dominant role in contributing to large grains and a high grain yield in awned wheat cultivars, particularly during the grain-filling stages [11].

Table- 5: The effect of removal treatments on means of yield and its components:

<i>Removal Treatments</i>	<i>No. of spikes / m<sup>2</sup></i>	<i>Spike weight / m<sup>2</sup> (g)</i>	<i>Average spike length (cm)</i>	<i>No. of spikelets / spike</i>	<i>No. of grains / spike</i>	<i>Grains weight / spike (g)</i>	<i>1000 - Grains weight (g)</i>	<i>Grain yield (ton/ ha)</i>	<i>Biological yield (ton/ ha)</i>	<i>Harvest Index (H.I.)</i>
<b><i>Qlyasan Location</i></b>										
<i>Control</i>	367.375	715.503	9.898	18.867	50.008	2.031	42.250	5.009	17.135	0.296
<i>Flag Leaf blade</i>	308.375	586.202	9.507	18.453	47.703	1.786	40.520	3.846	14.594	0.272
<i>Awn</i>	312.375	544.251	9.466	17.773	45.992	1.760	40.705	4.093	14.348	0.292
<i>Both</i>	335.875	540.363	9.542	18.063	47.984	1.630	38.702	3.700	14.339	0.268
<i>L.S.D (p ≤ 0.05)</i>	13.397	45.157	0.312	0.640	<i>n.s</i>	0.130	0.786	0.285	0.890	0.018
<b><i>Dukan Location</i></b>										
<i>Control</i>	631.750	975.958	10.648	18.641	53.441	1.375	40.691	4.945	28.794	0.168
<i>Flag Leaf blade</i>	483.375	656.858	10.478	18.617	52.063	1.343	38.843	3.556	20.722	0.170
<i>Awn</i>	500.938	658.513	10.447	18.078	50.383	1.284	38.994	3.452	22.427	0.152
<i>Both</i>	507.875	632.426	10.697	18.594	49.883	1.167	36.971	3.329	21.478	0.154
<i>L.S.D (p ≤ 0.05)</i>	20.488	33.727	<i>n.s</i>	0.424	2.504	0.107	0.746	0.263	0.860	0.012
<b><i>Average of both locations</i></b>										
<i>Control</i>	499.563	845.731	10.273	18.754	51.725	1.703	41.471	4.977	22.964	0.232
<i>Flag Leaf blade</i>	395.875	621.530	9.993	18.535	49.883	1.565	39.681	3.701	17.658	0.221
<i>Awn</i>	406.656	601.382	9.956	17.926	48.188	1.522	39.850	3.773	18.387	0.222
<i>Both</i>	421.875	586.395	10.120	18.328	48.934	1.398	37.837	3.514	17.909	0.211
<i>L.S.D (p ≤ 0.05)</i>	12.188	28.062	<i>n.s</i>	0.382	<i>n.s</i>	0.084	0.539	0.193	0.616	<i>n.s</i>

Table (6) show the effect of locations on yield and its components. It was observed that the effect of locations was significantly on all characteristics with the exception of number of spikelets/ spike and 1000-grain weight which were non-significant. The location of Dukan predominated the Qlyasan location in the characteristics of number of spikes/ m<sup>2</sup>, spike weight/ m<sup>2</sup>, average spike length, number of spikelets/ spike, number of grains/ spike, and biological yield, while Qlyasan location out yielded Dukan location in grain yield and some of important components such as grain weight/ spike and harvest index, this indicates the importance of grain weight/ spike in determining grain yield, while the out yielding some components in Dukan location such as number of spikes / m<sup>2</sup>, spike weight/ m<sup>2</sup>, spike length, number of spikelets/ spike, and number of grains/ spike may have a great role in out yielding biological yield in Dukan location comparing to Qlyasan location.

The exceeding of grain yield and some of its important components recorded in Qlyasan location may be resulted in the favorable environmental conditions due to this location and the values of these components affected significantly in the final grain yield. Similar results recorded by [36]. It is probably appeared that under well-watered conditions awns had an affect on yield only when assimilate supply was limiting. Awns did not always increase yield significantly in supra-optimal temperature [37].

The predominating of grain yield in Qlyasan location may be due the creating best environmental and soil conditions for planting growth, and increase in 1000- grains weight in this location was due to the differences between locations.

Biological yield was found to be greater in Dukan location in compare to Qlyasan. However, harvest index was higher in Qlyasan. The differences of yield and its components due to so many variables including genetic variation, cultural practices and environmental factors for example total precipitation (789 and 554) for Qlyasan and Dukan respectively and total ETo (32.5 and 31.3) for Qlyasan and Dukan respectively.

Table- 6: The effect of locations on means of yield and its components:

<i>Locations</i>	<i>No. of spikes / m<sup>2</sup></i>	<i>Spike weight / m<sup>2</sup> (g)</i>	<i>Average spike length (cm)</i>	<i>No. of spikelets / spike</i>	<i>No. of grains / spike</i>	<i>Grains weight / spike (g)</i>	<i>1000 - Grains weight (g)</i>	<i>Grain yield (ton/ ha)</i>	<i>Biological yield (Ton .ha<sup>-1</sup>)</i>	<i>Harvest Index (H.I.)</i>
<i>Olyasan</i>	331.000	596.580	9.603	18.289	47.922	1.801	40.544	4.162	15.104	0.282
<i>Dukan</i>	530.984	730.939	10.568	18.482	51.442	1.292	38.875	3.820	23.355	0.161
<i>LSD (P ≤ 0.05)</i>	<i>153.915</i>	<i>317.910</i>	<i>0.332</i>	<i>n.s</i>	<i>2.541</i>	<i>0.086</i>	<i>n.s</i>	<i>1.980</i>	<i>7.800</i>	<i>0.019</i>

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