

Agronomical Evaluation of Three Malt Barley Varieties Using Correlation and Regression Analysis Under Different Nitrogen Fertilizer Rate

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Abstract: The production and productivity of barley primary determined from the status its growth, phonological and agronomical parameters. But the direct and indirect effect of parameters as well as high its association with yield can't determine until correlation and regression was done. Therefore a field experiment was conducted on two different site of lemu bilbilo wereda from July- December 2018/2019 cropping season to study Agronomical evaluation of three malt barley varieties using correlation and Regression analysis under different nitrogen fertilizer rate. The experiment was laydown in split plot design nitrogen fertilizer as main plot and Varity as sub plot with in three replication. The treatments were five n fertilizer rate (11.5, 23, 34.5, 46 and 57.5) kg/ha as main plot and three malt barley varieties as sub plot factor and two site (Lemu burkitu and Bekoji negeso) kebele. The result showed that exept germination energy at Bekoji negeso and spike length at Lemu burkitu all parameters had significantly and positively correlated with grain yield. In addition to this spike / 50 cm had significantly and positively correlated with grain protein content, number of productive tillers per plant and plant height at both locations.

Keywords: Fertilizer Rate, Malt Barley, Varieties, Nitrogen, Correlation

1. Introduction

Cereal production and marketing are the means of livelihood for millions of households in Ethiopia and is the single largest sub-sector within Ethiopia's agriculture, far exceeding all others in terms of its share in rural employment, agricultural land use, calorie intake, and contribution to national income. Barley is the fourth most important cereal crop in the world after wheat, maize, and rice, and is among the top ten crop plants in the world [17].

Barley (*Hordeum vulgare* L.) is fast growing cool season annual grain crops. It belongs to grass family poaceae. It is grown over a wide range of soil and many adverse climatic conditions but predominantly it grow with an altitude range of 2000-3000 above sea level [12]. Next to wheat, rice and tef barley ranks fourth in term of production and productivity in the world [8, 16, 14, 10]. In Ethiopia, Barley production started long years ago and is largely grown as a food crop. According to [2] report barley growing in the central and northern parts of Ethiopia, including; Oromia, Amhara, Tigray, and Southern

Nations, Nationalities, and People's Region.

Barley is the most important staple food and subsistence crop in Ethiopia. Traditionally its grain used to prepared tela, kolo, enjera, malt, animals feed etc. The establishment of different malt factory in the 16th century dramatically increased the use of barley for malt purpose. Those establishments of malt factory lead to create high connection and opportunity between commercial brewer and industry [5]. Even if the malt barley production is increased in quantity its grain quality was remain low due to different biotic and abiotic factors such as soil erosion, lack of improved verities, in appropriate use of fertilizer primary nitrogen fertilizer, water logging, drought, frost, soil acidity [3, 18, 15].

Regarding the barley quality, it was observed that high protein content decreases the extract yield, turbid the beer and slows down the start of germination, while a too low protein content results in a lower enzymatic activity and slow growth of yeast in brewery [13, 11]. Grain N content is thus a determining factor of malt quality; high grain N content not

only means lower carbohydrate content and lower malt extract level. Grain quality and yield of malt barley is significantly influenced by rate of N fertilizer. Consequently assessing association of malt quality and different rate of N fertilizer is important since its fluctuation leads to significant loss for beverage industries and farmers. There for this experiment was done with the objective of agronomical evaluation of three malt barley varieties using correlation and Regression analysis under different nitrogen fertilizer rate at Arsi Zone Ethiopia.

2. Material and Methods

2.1. Description of the Study Area

The experiment was conducted during 2018/2019 main cropping season of two on- farmer site of Lemu-bilbilo wered. The experimental sites were located from 07° 30' 37" N - 39° 11' 31"E and from 7° 37' 19" N - 39° 23' 40"E and from 2400- 2780 m.a.s.l. respectively. The wereda receives mean annual rainfall of 951.5 mm. The monthly mean minimum and maximum temperatures were 4.05 and 19.88°C, respectively. The dominant soil type of this wereda was slightly acidic. The community's livelihood of this wereda is depend on crop cultivation and animal husbandry (dairy production, fattening). The major crops that grown in this wereda are cereal crops (wheat, food barley and malt barley), legume crops (faba bean, field pea), oil crops (linseed and Ethiopian mustard), and vegetable crops (Potato, cabbage, carrot). The major natural vegetation's that grown in the area were Korch, sensel, Eucalyptus tree natural vegetation [4].

2.2. Experimental Material and Design

The field experiment was laid out in Split-plot design with nitrogen fertilizer rates as main plot and malt barley varieties as sub-plot, replicated three times. The main plot factors contained five rates of N fertilizer (N1=11.5, N2=23, N3=34.5, N4=46 and N5 = 57.5 kg ha⁻¹) and the sub-plot factor contained three malt barley varieties (Holker, Ibon, Fanaka). Accordingly, treatments and treatment combinations were assigned randomly to the experimental unit within each block.

2.3. Experimental Procedure and Management

In accordance with the specifications of the design, a field layout was prepared and each treatment was assigned randomly to experimental plots within each blocks. The blocks were separated by a 1.5 m wide, whereas the plots within a block were 0.5 m apart from each other. Each plot consisted of 20 rows of 4 m in length and spaced 20 cm apart. The total and the net plot size were 10.4m² and 6m² respectively. Malt barely seeds, were planted at the recommended rate of 125 kg ha⁻¹. The seeds were planted in rows by using a manual row marker on the beginning of July, 2018 G.C. A blanket recommended rate of 100kg ha⁻¹ TSP (Triple supper phosphate) was applied across all treatments at the time of sowing and urea (46% N) fertilizer was applied

per treatment level evenly to the surface in two doses: half at planting and half at tillering stage. All other recommended cultural practices were properly followed to produce a successful crop. The grain was harvested within the range of middle of November to early December 2018, depending on the maturity date of each variety.

2.4. Correlation Analysis

Correlation analysis was conducted using Pearson correlation coefficient. Then path analysis was used to investigate cause relationships and direct and indirect effects of traits on grain yield and quality traits. Mean separation was employed following the significance of mean squares using Least significant difference (LSD) at 5% level of significance.

3. Result and Discussion

Correlation among studied parameters

The result indicated in (Tables 1 and 2) showed that all studied parameters except germination energy at Bekoji negeso and spike length at Lemu burkito kebele were significantly and positively correlated with grain yield. Result revealed that plant height ($r=0.370$ & 0.310), number of seeds/spike ($r=0.501$ & 0.535), spike /50 cm ($r= 0.538$ & 0.639), number of productive tillers ($r=0.614$ & 0.688), grain protein ($r= 0.382$ & 0.363) hectolitre weigh ($r=0.552$ & 0.543) and thousand kernel weigh ($r=0.755$ & 0.613) respectively at Bekoji negeso and Lemu burkitu kebele indicated that grain yield was depend on these all parameters. The positive and significant relation of grain yield with different agronomical parameters was elaborated with many authors [7, 1, 6] who stated that the grain yield was positively and significantly associated with plant height, spike length, total tillers, number of fertile tillers, biomass yield, straw yield, and thousand kernels weight. In addition to this [9] who found that grain yield was highly correlated ($P < 0.01$) with number of seed pod⁻¹, leaf area and number of branches of common bean.

Spike /50 cm had significant and positive association with number of productive tillers per plant ($r= 0.880$), grain protein ($r=0.564$), grain yield ($r=0.538$) and plant height ($r=0.514$) at Bekoji negeso and significantly and positively correlate with number of tillers per plant ($r=0.957$), germination energy ($r=0.389$), number of seeds/spike ($r=0.350$) grain yield ($r=0.639$) and germination energy ($r=0.389$) at Lemu burkitu kebele (Tables 1 and 2). Plant height had significant and positively correlate with number of seeds per spike ($r=0.486$), number of productive tillers ($r=0.505$), grain protein ($r=0.574$) and hectolitre weight ($r=0.499$) at Bekoji negeso and with number of seeds per spike ($r=0.474$) and with number of productive tillers per plant ($r=0.366$) at Lemu burkitu kebele. [7] Who stated that Grain yield was positively and significantly correlated with plant growth parametrs especialy plant height, spike length and number of fertile tillers.

Table 1. Correlation among the studied parameters at Bekoji negeso kebele Arsi Zone, Ethiopia.

	Ph	NSPS	SL	Sp	NPT	Gyq	Ge	Gp	HLW	TKW
Ph	1									
NSPS	0.486**	1								
SL	0.392*	0.281	1							
Sp	0.514**	0.141	0.298	1						
NPT	0.505**	0.206	0.295	0.880**	1					
Gyq	0.370*	0.501**	0.410**	0.538**	0.614**	1				
Ge	0.048	-0.11	0.03	0.283	0.360*	0.126	1			
Gp	0.574**	0.211	0.462**	0.564**	0.525**	0.382**	0.29	1		
HLW	0.499**	0.309*	0.179	0.187	0.061	0.552**	0.063	0.328*	1	
TKW	0.097	-0.082	0.246	-0.054	-0.108	0.755**	-0.077	0.163	0.281	1

Table 2. Correlation among the studied parameters Lemu burkito kebele Arsi Zone, Ethiopia.

	Ph	NSPS	SL	Sp	NPT	Gyq	Ge	Gp	HLW	TKW
Ph	1									
NSPS	0.474**	1								
SL	0.299	0.156	1							
Sp	0.052	0.350*	0.105	1						
NPT	0.366*	0.330*	0.198	0.957**	1					
Gyq	0.310*	0.535**	0.269	0.639**	0.688**	1				
Ge	-0.121	0.067	0.036	0.389*	0.365*	0.396*	1			
Gp	0.165	0.261	0.174	0.231	0.299	0.363*	0.322*	1		
HLW	0.32	0.294	0.282	0.137	0.191	0.543**	-0.088	-0.101	1	
TKW	0.087	-0.258	0.03	-0.337	-0.348	0.613**	-0.375	0.008	0.158	1

Where: Ph= plant height, NSPS= number of grains/spike, SL= spike length, Sp= spike /50 cm quadrant, NPT= number of productive tillers/plant, TKW= thousand kernel weight, HLW= hectolitre weight, Gp= grain protein content, Ge= germination energy, Gy= grain yield, NS= not significant, *= significant at 5% and **= significant at 1%.

4. Conclusion

The experiment was conducted from July - December 2018/19 cropping season at Lemu-bilbilo wereda on two on-farm site with an objective of agronomical evaluation of three malt barley varieties using correlation and Regression analysis under different nitrogen fertilizer rate. All parameters except germination energy at Bekoji negeso and spike length at Lemu burkito kebele were significantly and positively correlated with grain yield and the parameters spike/50 cm, number of seeds per spike and number of productive tillers per plant was the major contributors towards grain yield.

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