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Path Analysis of Grain Yield with Its Components in Durum Wheat under Drought Stress

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ABSTRACT

This experiment was conducted in order to study the path analysis of grain yield with its components in durum wheat under potential and drought stress condition during 2005-2006 cropping season in Agriculture Research Station of Tabriz Islamic Azad University. 49 durum wheat line (6 line from Iran and 43line from other fount) was used for this purpose. Two separate simple lattic design (7×7) with two replications was conducted . In one experiment, the plants were commonly irrigated until physiological but in another experiment drought stress imposed in four different stages including; tillering, stem elongation, anthesis and grain filling. Correlations among traits after combining two experiments was calculated by SPSS software . Harvest index(r =0.849**), plant height(r =0.695**), and number of tiller (r =0.689**) had high correlation with grain yield. Back ward regressions was used for regressing grain yield on its components. Number of seeds per spike (0.432) , length of spike(0.407) and 1000 seed weight (0.385) had the highest direct positive effects on grain yield. Path analysis for 1000 seed weight, number of tillers per plant and number of seeds per spike showed that plant height (0.452), length of spike (0.857), days to flowering (0.345) were the most effective components of traits, respectively. Therefore, traits such as number of seeds per spike, spike length and 1000 seed weight could be used as a suitable indices in irrigated and dry farming conditions for obtaining durum wheat genotypes with high yield.

KeyWords: Correlation, Drought stress, Durum wheat, Path analysis.

INTRODUCTION

The insufficiency of water is the principle environmental stresses and to enter heavy damage in many part of the world for agricultural products (Volaire,2003;Yu and Setter,2003). Connies(1987) defined drought as a lack or leakage of rainful in part of time that cause decrease in growth of plant and thus economic production. The insufficiency of water in different growth stages, effect plant physiological activities until seed formation and seed and filling period. Yield components of cereal seeds consist of g number of spike per surface Area, number of seeds per spike and 1000 seed weight not only have compensational effect to each other, but they are most effective factors in grain yield of cereals(Rasmusson and Chanel,1970). Mohammedi (1998) reported that correlation between dry land

wheat grain yield and 1000 seed weight, plant height, tiller no, length of last internode, seed no per spike and harvest index are significant and positive. also Darwinkal(1978) reported positive correlation between grain yield with 1000 seed weight and number of seed per spike in wheat.

According to path analysis in durum wheat genotypes, number of seeds per spike, 1000 seed weight and number of tillers have direct and positive affects yield(Gebeyehou et al, 1982;Monral et al,1997;Simane et al.1993). Kumar and Gupta(1984) reported direct positive but little affect of plant height, number of seeds per spike, 1000 seed weight and number of tiller on yield.

Objects of this experiment was to define correlations between traits correlated to grain yield in drought stressful condition and non stressful condition and also characterize traits that have highest direct and indirect effects on durum wheat yield in this condition.

MATERIALS and METHODS

This experiment conducted in Agriculture Research station of Tabriz Islamic Azad University during 2005_2006. 49 durum wheat line (6 line from Iran and 43 line from other countries) was used for this purpose. Two separate simple lattic design experiment (7×7) with two replications was conducted. In one experiment, the plants were commonly irrigated until physiological maturity but in another experiment drought stress imposed in four different stages including: tillering, stem elongation, anthesis and grain filling for study correlations among traits and also regression method and path analysis grain yield after combining two experiments was calculated buy Excel,Spss and Path2 software.

RESULTS and DISCUSSION

Correlation coefficients grain yield was significant and positive with plant height, length of spike, peduncle length, number of tiller per plant, harvest index and number of seed per spike.
Therefore increases in every traits mentioned above, result in increases in grain yield (table1).

Correlation between grain yield with harvest index were much more than correlation of grain yield with other trait($r= 0.849^{**}$), thus with increasing grain yield, other traits also increased but not in case of this increase in harvest index.

Correlation between yield and its components showed significant and positive correlation between yield components of number of tiller ($r = 0.689^{**}$) and number seed per spike ($r = 0.387^{**}$) with grain yield, also 1000 seed weight ($r = 0.013^{ns}$) don't show linear correlation with yield. Besides, according to results of table 1 that show correlation of two traits of seed per spike with 1000 seed weight significant and negative($r = -0.284^{**}$). Can conclude that by increasing number of seed per spike, 1000 seed weight decreases and reverse. Monral et al,(1997) reported significant and positive correlation between grain yield with number seeds per spike and 1000 seed weight.

In path analysis grain yield, number of seeds per spike have most coefficient and is first rate, length of spike is next rate regression coefficients. So this traits can cause increases of gain

yield.(Table2). Darwinkal (1978) reported important direct effect of number seed per spike on grain yield.

1000 seeds weight direct effect on yield also was significant but number of seeds per spike and length of spike indirectly and by 1000seed weight can cause to yield losses that this can be due to negative correlation between 1000 seeds weight and seed no per spike ($r = -0.284^{*}$) and spike length ($r = -0.478^{**}$).

Path analysis for 1000 seed weight showed direct significant and positive affect plant height on 1000 seed weight. Results showed that 1000 seed weight increases is by increases in plant height(0.424) and flag leaf surface (Table 3).

Path analysis number of tiller showed that spike length (0.857) have highest significant and positive effect on number of tiller, Indirect effect of its by way of 1000 seed weight (-0.132) is less and negative (table4).

In path analysis number of seeds per spike basis direct effect days to flowering positive and was significant in 1% levels. Therefore can conclude that increase number of seeds per spike. 1000 seed weight direct effect(0.351) was significant and negative on number of seeds per spike that subject attentive negative correlation($r = -0.285$) between this two traits is logical(table5).

Thus in this experiment condition three trait, number of seeds per spike, length spike and 1000 seeds weight respectively have direct effect most on grain yield. Therefore can in stress conditions use of two traits number of seeds per spike and length of spike index selection. Simane et al,(1993) reported effect number seeds per spike more than its components and to introduce that one selection index suitable in drought conditions.

Table 1. Correlation between traits for each two experiment

Trait	Plant height	Length of spike	Peduncle length	Number tiller	Harvest index	Number of seed per spike	1000 seed weight	Chlorophyl flag leaf	Surface flag leaf	Days to flowering
Length of spike	0.670**									
Peduncle length	0.714**	0.321*								
Number tiller	0.634**	0.746**	0.427**							
Harvest index	0.446**	0.365**	0.269	0.592**						
Number of seed per spike	0.126	0.113	-0.15	0.128	0.586**					
1000 seed weight	-0.4	-0.478	0.187	-0.252	0.068	-0.284*				
Chlorophyl flag leaf	-0.108	-0.404**	0.063	-0.373	-0.018	0.163	0.384**			
Surface flag leaf	0	-0.067	-0.059	-0.238	0.004	-0.01	0.401**	0.364*		
Days to flowering	0.218	0.227	-0.159	0.08	0.254	0.407**	-0.097	0.107	0.121	
Grain yield	0.695**	0.591**	0.466**	0.689**	0.849**	0.387**	0.013	-0.127	-0.03	0.241

** and * Significant at the 1 and 5% levels of probability, respectively

Table 2. Path analysis grain yield with its components for mean numbers of two experiment under stress drought and potential condition durum wheat.

		Indirect effects					
Trait	**Direct effect**	Length of spike	Peduncle length	Number tiller	Number of seed per spike	1000 seed weight	Correlation trait with yield
Length of spike	0.407**	---------	0.057	0.261	0.048	- 0.185	0.591**
Peduncle length	0.178**	0.13	--------	0.149	- 0.065	0.072	0.465**
Number tiller	0.352**	0.304	0.076	---------	0.055	- 0.098	0.689**
Number of seed per spike	0.432**	0.046	- 0.027	0.044	----------	- 0.11	0.386**
1000 seed weight	0.385**	- 0.195	0.033	- 0.089	- 0.123	--------	0.013

** and * Significant at the 1 and 5% levels of probability, respectively

Table 3. Path analysis for 1000 seeds weight in average two conditions stress and potential

Indirect effects

Trait	Direct effect	plant heights	Length of spike	number of tiller	number of seed per spike	Surface flag leaf	Correlation trait with yield
plant heights	0.424**	----------	- 0.626	0.194	- 0.034	0	- 0.04
Length of spike	- 0.935**	0.284	----------	0.228	- 0.031	- 0.028	- 0.478**
number of tiller	0.306**	0.269	- 0.697	----------	- 0.035	- 0.098	- 0.253
number of seed per spike	- 0.268*	0.053	- 0.106	0.039	----------	- 0.005	- 0.285*
Surface flag leaf	0.408**	0	0.062	- 0.074	0.002	----------	0.4**

** and * Significant at the 1 and 5% levels of probability, respectively

Table 4. Path analysis for number of tiller in average two conditions stress and potential

Indirect effects

Trait	Direct effect	Length of spike	1000 seed weight	surface flag leaf	Correlation trait with yield
Length of spike	0.857**	---------	- 0.132	0.019	0.745**
1000 seed weight	0.274*	- 0.411	--------	0.117	- 0.253
Surface flag leaf	- 0.291**	- 0.058	0.11	-------	- 0.239

** and * Significant at the 1 and 5% levels of probability, respectively

Table 5. Path analysis for number of seeds per spike in average two conditions stress and potential

Indirect effects

Trait	Direct effect	1000 seed weight	Chlorophyl flag leaf	days to flowering	Correlation trait with yield
1000 seed weight	- 0.351**	---------	0.1	- 0.034	- 0.285*
Chlorophyl flag leaf	0.261*	- 0.135	---------	0.036	0.163
days to flowering	0.345**	0.034	0.027	---------	0.407**

** and * Significant at the 1 and 5% levels of probability, respectively

REFERENCES

Connies, S. 1987. Cell wall proteins at low water potentials. Plant Physiol. 85: 261-267.

Darwinkal, A.1978. Pattern of filling and grain production of winter wheat at a wide range of plant densities . Neth . J . Agric Sci . 26:383-398.

Gebeyehou.G., D.R. Knott, and R.J.Baker.1982. Relationships among duration of vegetative and grain filling yield component and grain yield in durum wheat cultivars. Crop Sci.22: 287-290.

Kumar,D, and S. Gupta. 1984. Correlation and path coefficient analysis in barley grown on normal and saline soils Indian. J. Agri. Sci, 45:356-358.

Mohemmedi, M. 1998. Assessment correlation trait with grain yild in wheat under face condition. Agriculture Research Station of Kohkiluye and BoyerAhmed.Iran.77.232.

Monral, A.B., D.P.Sadhu and D.P.S.Sarkar.1997. Correlation and path analysis in bread wheat. Environment and Ecology, 15(3):537-539.

Rasmusson, D.C, and R.Q.Chanel. 1970. Selection for grain yield and components of yield in barley. Crop Sci, 10:51-54.

Simane,B., P.C.Struit., M.M.Nachit, and J.M. Peacock. 1993. Ontogenetic analysis of yield components and yield stability of durum wheat in water-limited environments. Euphytica,71:211-219.

Volaire , F. 2003. Seedling survival under drought differs between an annual (*Hordeum vulgare*) and a perennial grass . New Phytologist, 23: 501-510 .

Yu , L, and T.L. Setter. 2003. Comparative transcriptional profiling of placenta and endosperm in developing maize kernels in response to water deficit. Plant Physiology,31: 568-582.