Evaluation of Bread Wheat (Triticumaestivum L.) Genotypes for Yield Potential and Related Traits under High Temperature Stress Condition at Middle Awash, Ethiopia

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Abstract

Wheat is one of the most important cereal crop world-wide that grown in many areas and major staple crops in Ethiopia but its production at lowland areas are very limited because of this lowland areas in Ethiopia are characterized by higher temperature and low rainfall condition, mostly are not suitable for crop production. In addition to this bread wheatis very susceptible to high temperature stress condition and their adaptability and also lack of variability of genotypes in lowland stress environment is a key factor. Therefore mostly wheat production in the country is in mid to highlandareas, so that the practice of wheat production in lowland stress area is scarceor not available.Thus, information on the extent and performance of genotypes present in a crop species under high temperature stress are essential for effective crop adaptation program. To generate these information 36 bread wheat genotypes with three released varieties (Fentalle, Amibara and Werer-2) were tested at the Werer agricultural research center, Afar in 2017 in Triple Lattice Design with three replication.

The research aimed at developing best performed bread wheat genotypes that adapted to middle Awash region and identifying best performed bread wheat genotypes for yield under high temperature stress conditions. The data generated from the experiment like days to emergence, days to heading, days to maturity, grain filling period, plant height, spike length, total tillers, effective tillers, number of kernel per spike, spike fertility, canopy temperature(measured with an infrared thermometer during grain filling stage and time of measurement was from 11:00 am to 2:00 pm during the peak noon at middle awash case with expected high intensity time for temperature), chlorophyll content(a flag leaf per plant from sample plants per plot was measured using a portable chlorophyll meter SPAD-502 plus at grain filling period), biomass yield, thousands kernel weight, yield per hectare and harvest index were subjected to analysis of variance.

The analysis of variances of bread wheat genotypes evaluated for their traits revealed highly significant difference between the genotypes for most traits and significant difference among genotypes for days to emergence. The significant difference between genotypes for the characteristics suggested indicated the existance of a considerable amount of variability between genotypes, which is an important for the study of plant breeders for enhancement of these traits through breeding especially for lowland high temperature stress environment. It was interesting to note that in this study genotypes identified for short grain filling period and early maturing were Genotype-4, Genotype-18, Genotype-3, Genotype-26 and Genotype-15 with maturity days of 70, 76, 77, 77 and 79 days after sowing respectively, than the released check variety Werer-2 (84 days).

Therefore, genotypes that are characterized by an early maturity and short grain filling time of grain may be promising, since this adaptation method is associated with an escape mechanism for high temperature stress condition. So, a strategy to develop high temperature tolerant genotypes and the focus of crop improvement was on developing short duration varieties for lowland high temperature environment.Similarly genotypes-16, genotypes-22, genotypes-28, genotypes-32 and genotypes-34 had better required low canopy temperature reading than released check varieties Fentalle, Amibaraand Werer-2. The study result indicated that the highest canopy temperature relatively produced low yield and vice versa. Low canopy temperature under high temperature stress is associated with tolerance in wheat.

Therefore, low canopy temperature reading genotypes in this study might be promising for developing high temperature stress tolerant variety. In addition genotypes-7, genotypes-17, genotypes-19 and genotypes-26 had relatively more chlorophyll content than check varieties of Fentalle and Amibara. This result could also indicate that genotypes with high chlorophyll content might be selected to develop high temperature stress tolerant genotypes.

Therefore the physiological parameter had a key factor in developing wheat genotypes under stress environment. In this study also there were seven genotypes G-2, G-7, G-16, G-17, G-23, G-28 and G-32 that scored higher biomass yield than the best released check variety Werer-2. Biomass yield is one of the features needed by agro-pastoral group for their livestock feed during dry season where forage is inadequate. Hence, the identification of higher biomass yield genotypes may fit with the need for the study area's of agro-pastoral community. Grain yield

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had the most important characteristics in any bread wheat evaluation program particularly under conditions of high temperature stress. From the current findings the most important genotypes for showing excellent performance on grain yield per hectare obtained from genotype-2, genotyp-7 and genotyp-21 with grain yield of 2479 kilo gram per hectare, 3039 kilo gram per hectare and 2409 kilo gram per hectare respectively, than the best performed released check variety Werer-2. These results revealed that promising genotypes for yield under high temperature stress condition. Hence, from the current results it has been observed adequate existence of traits showing adaptability in the studied genotypes under stress environment including availability of high yielding genotypes and this could be exploited in future bread wheat selection and breeding for high temperature stress condition.

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