Review paper: Agricultural and environmental effects on wheat's Quality and yield.

Rabia saif[1], Muhammad Tariq[1], Chanda Ashraf[2].

[1]Department of Plant Breeding and genetics, University of Agriculture, Faisalabad, Pakistan.
[2]Wheat Research Institute, Ayub Agriculture Research Institute, Faisalabad.
[2]Cereal and Pulses Section, Agronomic Directorate, AARI, Faisalabad.
Rabiasaif51@yahoo.com

Abstract: Wheat is a major crop sown all over the world on large area. Almost whole world depend upon it for daily requirements. The purpose of this review is to see the wide range of effects of different factors on the yield and quality of wheat in both positive and negative aspects and to know that how we can cope with these situations. Fertilizer had an effect on the grain yield directly or indirectly. In different rainfed conditions fertilizer and FYM affected the yield. Nitrogen utilization and use efficiency under different environmental conditions increased the yield by effected the protein contents. Temperature, drought, heat all effected the wheat during grain filling stages, at different levels of anthesis and maturity. Different cultivars showed different behavior at different temperatures. So much increased temperature decreased the yield such as above 35^0C after anthesis. Location also affected the grain quality of wheat. At grain development and grain filling different stresses affected the quality and yield. . Irrigation techniques and water stress affected the grain quality. CO_2 level at different irrigation and fertilizer levels increased the grain yield. Weeds decreased the grain quality and grain yield. Diseases such as Leaf Rust, black point infection and powdery mildew decreased the grain yield by lowered their quality. Late frost also decreased the grain quality.

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Introduction:

Cereal crops:

Cereal grains have been the foremost portion of human diet for thousands of years and have a energetic role in influencing human civilization. All over the place in the world, rice, wheat, and maize and to some extent, sorghum and millets, are central staples important for the daily survival of billions of people. More than 50% of world gets their everyday calories from the cereal crops.

Wheat as a major crop:

Wheat is the furthermost significant grain and a principal food for more than one third of the world population.

Wheat is the most extensively full-grown crop in the world and delivers 20% of the everyday protein and food calories for 4.5 billion people. It is the second significant food crop in the developing countries after rice. With the growing population, the request for wheat is predictable to enhance by 60%. To encounter this, annual wheat yield increases must rise from the current level of less than 1% to at least 1.6%. All countries share the need to rise wheat yield, tolerance to abiotic stresses, pathogens and pests, as well as to recover input use efficiency for additional maintainable wheat production. Better agronomic practices and development of innovative cropping systems are also a priority.

Area and Production of wheat:

It is sown on 220 million hectares all around the world and it has 564.6 million tons production, an average of 2500 kg grain per hectare. China produces wheat on about 30 million hectares, after that Russian; India, the USA, Australia, Canada, Turkey and Pakistan. As far as the question about maximum yield is concerned France produces 7200 kg per hectare because it has much lengthier growing season of winter wheat.

Agricultural and Environmental effects:

Effects of fertilizers on wheat which were applied on the flag leaf and on ear emergence and were compared with the untreated. Weeds were controlled by the application of glyphosate, ploughing and seed bed cultivation. At flag leaf emergence Famoxadone + flusilazole, strobilurin + azoxystrolin and famoxadon + flusilazole were applied and then later applied at ear emergence. Plants were selected randomly from anthesis to harvesting and ears were observed. Grains were selected from medial ear and from apical position. Moisture contents were gravimetrically derived and canopy temperature was also taken. It is observed that strobilurin treatment increased the moisture content which plays an important role in the grain maturation. Fungicide had not any effect in the grain drying. When grain moisture content was 40% slightly drying was observed. The plants that had more green leaf area their canopy temperature was less but positively related with hagberg falling number. HFN was negatively related with GMC and mean grain weight. GMC also had an effect on black point. Black point was positively related with GMC and MGW and also affected by genotype. Flusilazole had intermediate effect between untreated and azoxystrolin treated plants (Dimmock et al., 2001).

Effects of timing, drought and high temperature on the grain development were observed. Drought and temperature were applied on the grain filling stage which reduced the period of grain filling and ultimately reduced the yield. It also had a negative effect on mean grain weight and on specific weight. Grain filling was affected during 1-14 days of anthesis. Nitrogen harvest index was less affected that's why at the end of grain growth protein contents were increased but stresses decreased the dry matter index. Sulphur contents were also not effected. Restricted water effects on grain yield and quality were linearly related with soil moisture and with field capacity. Drought stress which was given from 15-28 days it lessen the SDS- sedimentation while temperature has less effect at the end of grain filling as compared to drought given at the late stage (Gooding et al., 2002).

Heat stress to the two isogenic lines which comprised Glu-Dld and Glu-Dla was given. Firstly 20/16^{o}c Day/Night temperature was given from planting to maturity. Secondly 20/16^{o} c was given but only for three days 35/20^{o} c was given after 25 days of anthesis. Thirdly 20/16^{o} c was given after 25 days of anthesis and then 40/25^{o} c was given till maturity. At next year second treatment was changed to 40/25^{o} c for three days after 25 days of anthesis. Seeds were collected after 16 days of anthesis with 3 days of interval and analyzed for protein composition. The variety with Glu-Dld showed higher molecular weight of glutenin at maturity. It is concluded that timing, rate of glutenin polymerization and the timing of applying temperature are important factors on heat stress and functionality (Irmak et al., 2007).

In saline soil the effect of different irrigation techniques on yield was observed. Germination was good at bed and furrow irrigation with 36.5 % less water applied and had 13.4 % more grain yield by these methods as compared to flat border method where water was standing at the time of rain and had poor surface drainage. Bed and furrow technique is good for germination and plant growth (Ahmad et al., 2010).

In turkey water stress at different stages as fully irrigated, rainfed, early water stress, late water stress and continuous water stress to check quality characteristics and on season cropping was given by Ozturk and Aydin (2003). In different cropping season CWS, EWS AND LWS lessened the grain yield as 65.5%, 40.6% and 245% respectively which were compared with FI. CWS increased the grain protein contents by 19.1%, sedimentation volume 16.5%, gluten content 21.9% but decreased the 1000-Kernal weight to 7.5g as compared to FI. LWS increased the grain protein content to 8.3%, SD to 8.7%, Gluten content to 10.8% and decreased weight to 3.8g as compared to FL. EWS had more negative effect on weight. LWS had more affect then EWS on grain quality. Soil moisture condition increased the grain yield and weight in winter wheat but lessened the wheat quality

Under rainfed conditions different combinations of NPK and FYM on same wheat variety was used. Experiment was conducted in split plot, in main FYM and in sub-plot NPK was applied. Different levels of NPK and FYM in separately and in combination had significant effects on emergence m^{-2}, spikes m^{-2}, grains/spike, biological yield (kg/ha) and thousand grain weight. At 80-60-60 NPK/ha increased the grain spike emergence, total grain weight and biological yield. 80-60-60 kg/ha produced more spikes m^{-2}, spike grain, total grain weight and biological yield. 30t/ha also produced same results. It is concluded that 80-60-6- kg/ha and 30t/ha had produced more biomass and yield components under rainfed condition (Rehman et al., 2008).

Accumulation of KCL/ Methanol insoluble albumin and globulin on the endosperm of developing wheat was observed. After applied 24/17^{0}c day/night and high 37/28^{o}c temperature after 10-20 days of anthesis till maturity. It is observed that high temperature lower the protein profiles at grain filling stage but did not change the developmental program. Due to this the role of protein changed to protect the biotic and abiotic stresses instead of biosynthesis and metabolism. At late stage of grain development the level of protein changed. Protein respond towards temperature and it depends on that temperature is given on early or mid-stage of development (Hurkman et al., 2008).

Sehar-2006 at different rates of nitrogen as 0, 80, 130, 180 kg/ha was checked. Seed rate was 100 kg/ha was checked. Nitrogen levels were increased and it had significant effects on tillers/unit, plant height, spikes' length, no. of grains/spike, 100 grain weight and on grain yield. By applying 180 kg/ha 3.848 tons/ha yield was obtained (Ali et al., 2011).

Environment and genetic effects on Routine APS /M-N was observed by Asseng and Milory (2006). If nitrogen is sufficiently available in crop at grain filling then grain protein was 17%. By daily nitrogen protein in the grain accumulated and grain weight accumulated because temperature affected them.

Upper boundary and lower boundary of protein accumulation was 23% and 7%. During grain filling high temperature increased the nitrogen accumulation and decreased the grain weight accumulation as a result of which at grain maturity protein contents were high. Due to les rainfall water shortage had negative impact on grain number/ unit area, grain size and on nitrogen accumulation due to which grain protein contents increased. Water shortage at early stage of grain filling had less positive impact on protein contents. Nitrogen supply affected the grain protein but somewhat it depended on the season. Location by mean of rainfall temperature index decreased protein contents due to increase in grain dry matter and genetic yield plot also increased. As yield increased grain protein became less by optimal water and nitrogen supply. Temperature, water shortage and increased nitrogen had linear relationship with protein. Negative relationship between grain yield and grain protein contents showed the genetic limitations of protein contents.

Three cultivars Lavett, Ciano-79 and Attila (showed different responses towards heat) in the glass house at different temperatures of 12-h day length first at 15/10^{o} c were sown. From sowing to the end of the tillering different regimes 20/20 and 18/13^{o}c during natural day length was given. Heat shock was given, during 12 hours 30^{o}c was applied and 38^{o}c for 3 hours was applied for three days till the end of grain tillering which effected the leaf photosynthesis. During grain filling it effected the grain growth and photosynthesis both. It decreased the leaf photosynthesis from 40-70% which depended upon cultivar and developmental stages. At the end of heat shock protein recovered within four days. Heat shock had more effect on early grain filling instead at the end of tillering. However effect of 3 days heat shock treatment was less than the temperature which was given before and after sowing (Schapendonk et al., 2007).

Grain weight of wheat and crude protein contents on the bases of cultivars, nitrogen fertilizer and weather data were observed by Smith and gooding (1999)**.** Further analysis was done for grain quality at different places. Crude protein contents were described that how it was effected. Locations showed significant effects on crude protein. Cultivar quality had negative impacts on the crude protein but had positive effects on the specific grain weight

Effect of heat stress on grain dry mass and on quality in spring wheat genotype was experimented. Three cultivars one for temperate growing condition, 2 CYMMIT cultivars which were heat sensitive and heat tolerant selected for warm climate. Plants were grown at different temperatures i.e.to 18/30^{o}c and 25/20^{o}c day/night and heat5 shock was given for three days during grain filling phase. To some extent heat shock affected the grain quality during grain filling depending upon the heat tolerance of genotype and on growth temperature. Grain size and dry matter decreased whereas protein related traits improved. In Lavett genotype there was a negative correlation between grain dry matter and flour protein. In Attila protein concentration remained stable under wide range of grain dry matter. Ciano-79 showed intermediate effect between these. These genotypes had significant potential to maintain quality in adverse conditions. At 18/13^{o}c heat shock was more as compared to 25/20^{o}c. especially grain dry matter decreased however flour protein, GMP protein fraction, GMP quantity and partical size increased. Quality and yield can be improved by heat shock treatment during early grain filling (Spiertz et al., 2006).

In mature wheat monomeric and polymeric plays an important role on proteins and solubility in wheat flour properties and their use said by Daniel and Triboi (2001). Contents of SDS-soluble and SDS-insoluble protein and their ratio are useful in the evaluation of flour properties. In the experiment ratio was affected by temperature and water stress during grain filling. Effect of temperature and water availability was studied on SDS-Soluble and on insoluble protein accumulation by HPLC size exclusion. At 400-500^{o}c quantity of both increased. Quality of soluble is 60 times more than insoluble. On per day basis accumulation of protein increased by temperature but did not modify by drought. Insolubilization in insoluble protein effected, temperature did not modify the Insolubilization but drought done. Grain development was linked with water dynamics in grain under environmental effect.

Plants were given 37/17^{o}c, 37/28^{o}c and 24/17^{o}c during grain development. Plants which were given 24/17^{o}c had less kernel weight, maximum dry weight and less harvest maturity time. At this rate early starch accumulation was observed. Apoptosis in endosperm also took less time at high temperature and concided with physical maturity. When drought was also added to 37/17^{o}c it further lessen the maximum water content, dry weight and duration of starch accumulation but protein accumulation and kernel desiccation remained unaffected. Fertilizer after anthesis did not affect the water content. Dry weight, apoptosis, harvest maturity and starch accumulation under any temperature but post-anthesis fertilisation decreased the rate and duration of protein accumulation (Altenbanch et al., 2001).

Specific conditions of a year and agronomic practices on 14 common winter wheat varieties were observed by Ivanova and Tsenov (2010)**.** Genotypes were divided into 2 groups on the basis of their grain quality. After many crops different nutritional regimes were applied to see grain yield, test weight, 1000 kernel weight, and length of main spike and weight grains per spike. $N_6P_6K_6$ and $N_6P_6K_0$ were applied after bean and $N_{14}P_{14}K_0$ were applied after grain maize and maize fodder to wheat. Year had a great impact on plant height, test weight, main spike length and weight of grain/spike in both groups. Mineral fertilisation increased the grain yield and productive tillers of both groups. 1000 grain weight was more affected by genotype. In group B yield was more which was due to more grains of larger size/ spike whereas productive tillering of group A was less.

Different nitrogen levels such as 84, 128, 150, 175, or 200 on uqab-2000 were applied. At 150kg/ha productive tillers/m$^{-2,}$ 1000 grain weight and grain yield was more as compared to 175kg/ha. At 200kg/ha max. Plant height and no. of grains/spike were obtained (Ali et al., 2003).

Temperature such as 0, 2, 4 and 6^{o}c and 380, 420, 460 and 500 ppm elevated CO_2 was applied on winter wheat. Yield decreased above 6^{o}c and 37% increased below this temperature. Elevated CO_2 affected the yield, grain no., leaf area and biomass. It decreased the harvest index and evapotranspiration and did not affect the flowering date, maturity and 1000 seed weight. CO_2 level increased above 40ppm in all treatment it increased the yield up to 150kg/ha (Tonakaz et al., 2010).

Nitrogen was supplied to the grain which increased the total protein, protein unit and sub-unit. As protein increased Glutenin contents, gliadin contents and their ratio increased. Gliadin as compared to glutenin showed high correlation with total protein content. In Rinconod variety glutenin contents were high as compared to Bancil. High and low molecular weight and LMW fraction increased by increasing total glutenin but their ratio remained constant. HWM quantity increased by increasing HMW-glutenin. LMW and HMW were more stable in Bancil as compared to Rinconod (Triboi et al., 2000).

Plow-tillage and Rotary-tillage decreased the soil bulk density at 0-20cm soil depth and penetration resistance at 0-30cm depth. By PT root length density (RLD), root density and root surface density (RSD) was more as compared to No-tillage. Soil water contents at PT and RT were lower whereas at NT these were more across 0-110 cm from tillering to flowering stage but at NT at 0-20cm soil profile water contents were more at ripening stage. Evapotranspiration at PT and NT at sowing to flowering stage was more as compared to RS. Tillage practices had no effect on pre-planting soil water storage. Grain yield was significantly increased through spike no. and grain weight. Temperature increased the water use efficiency but decreased the soil bulk density and penetration resistance which increased the RLD, RWD and RSD from tillering to flowering stage. This also increased the plant population, grain yield and water use efficiency in rainfed areas (Guan et al., 2014).

The plant gave the increased grain yield when provided with 160kg N/ha and 30 Mg comp/ha. When nitrogen level increased yield components such as spike/plant, seed/spike and 1000 kernel weight significantly increased. The results of 160kg N/ha and 240kg N/ha was same to some extent. At these levels there was no significant difference in seed protein and gluten but at all nitrogen levels 60Mg/ha had effect on seed protein. At ear emergence by 160kg N/ha and 60Mg comp/ha protein density was increased while no difference was observed in seed water soluble, Albumin protein and Globulin. Maximum grain yield, protein and gluten was obtained at 160kg/ha Nitrogen, showed that by compost and less fertilizer we can attain more yield (Abedi et al., 2010).

Increased yield decreased the starch protein ratio and oil ratio (Triboi et al., 2006). C-assimilation increased instead of N. protein is important quality factor in flour for bread making. N components had negative co-relation with grain yield. After anthesis temperature and water shortage had effect on protein and grain yield but did not modify the negative relation between these two variables whereas the water shortage decreased the sink-source ratio. It was concluded that: At stem level negative relation can be determined. Secondly, grain is limited on starch synthesis instead of protein synthesis. Thirdly, by N utilization and use efficiency can increase yield.

Experiment in free air CO_2 (FACE), in wet and dry irrigation, at high and low nitrogen was done. Dry treatment improved the grain quality (protein +2% and bread oaf volume +3%). Low nitrogen decreased protein to -36% and BLV to -26%. At ample water and nitrogen free air CO_2 decreased the quality as protein -5% and loaf volume -2% but at low nitrogen FACE did not effect. At ambient CO_2 and at FACE low nitrogen lessened protein -33% and -39% and loaf volume to -22% and -29% respectively. Data told that in future elevated CO_2 concentration increased the effect of low soil nitrogen on grain quality but at ample nitrogen fertilizer effect will be less (Kimball et al., 2001).

Genotypes on different irrigation levels and at 2 nitrogen levels were grown. Moisture stress during grain filling increased the flour protein content. By nitrogen fertilisation protein content increased. Flour protein and grain polyphenol oxidase had no co-relation. Protein composition changed as protein contents increased. By increased Monomeric protein flour protein also increased. By protein content SDS-sedimentation increased. Genotypes with same protein quality and composition gave same response at nitrogen and irrigation (Pierre et al., 2007).

Wheat kernel development into three phases; cell division, Enlargement and dehydration was divided by (Naeem et al., 2012). Gluten protein accumulated till the end of cell enlargement phase. During dehydration large glutenin polymers formed. By polymer protein glutenin polymers increased. HMW-GS (high molecular weight glutenin subunits) which were related with dough-strength accumulated large polymer as compared to those lines in which HMW-GS was related to dough weakness kept their level high till maturity due to cysteine. Sulphur deficiency which occurred caused Bucky dough property flour. Increased temperature during grain development lessened the dough strength but HWS showed tolerance towards heat stress.

Nitrogen fertilisation effect the globulin and Albumin in wheat flour and strongly affect the gluten protein as compared to Gliadians which had more effect on them said by Wieser and Seilmeier (1997). Whereas major types of protein had more effect than minor. Hydrophilic nitrogen increased and hydrophobic protein decreased by increased nitrogen.

Plants at correct Nitrogen level showed no change in growth respiration co-efficient whereas it is affected by lowering nitrogen 10% observed by Gifford (1995). Respiration co-efficient were effected by less change in CO_2 concentration. Dry weight maintains decreased 13% and respiration co-efficient 20% due to elevated CO_2 as compared to ambient. Temperature increased +5% affected the crop. Dry weight maintaince co-efficient (rm) and growth respiration co-efficient (rg) decreased when growth temperature increased from 15 to 20^{o}c. Above 20^{o}c rm became temperature insensitive whereas rg increased by growth temperature. Respiration: photosynthesis ratio increased from 0.40-0.43 when temperature was 15-30^{o}C. It was concluded that it is better to use R: P content on average temperature and CO_2 at which wheat can response well at climatic change.

Competition of weeds with crop was observed. From 30, 40, 50 to 110 days and in whole season weeds had an effect on the no. of tillers/square meter, no. of grains, 1000 grain weight and grain yield. Highest grain yield 5.06 t/ha was in the plot from which weeds were removed after 30 days. 4.96 t/ha yield was at 40 days and 4.85 t/ha at 60 days. When after days weeds were allowed to grow a reduction in grain yield and yield components were observed but weeds increased dry and fresh weight. 47.95% decreased in yield took place in whole season. Critical competition was observed between crop and weed between 30-50 days after sowing (Chaudhary et al., 2008).

Effect of climate change on productivity in Punjab province, Pakistan was observed. At sowing stage 1^{o}C decrease in temperature increased the productivity 146.57kg/ha. At vegetative stage increase in Mean maximum temperature lessened the productivity as it fastened the vegetative growth and decreased the grain development period. By increased 1^{o}C mean maximum temperature yield was 136.63kg/ha. Adequate amount of rainfall also increased the productivity (Ashfaq et al., 2011).

Grain yield depended upon anthesis date and grain development and grain number/m in dry season said by Brill (2015). There was a weak relation between grain yield and anthesis date during favorable season and weak relation was observed between grain yield and weight. Grain number had a relation with grain yield instead of rain weight was effected by pre-anthesis.

Increased temperature, elevated CO_2 and rainfall differed according to soil type and location. High CO_2 amount increased the yield at drier sites whereas at cooler region increased temperature had a positive relation with yield. Heavy clay soils were vulnerable at reduced rainfall whereas sandy soils were at high temperature. Early flowering varieties increased the production at less rainfall and at ambient temperature. Increased temperature at late maturity gave more wheat production. At clay soil early vigor did not improve the yield. At this rooting depth also did not increase the yield which made this vulnerable for dry climate. At loamy sand soil by early vigor rooting depth increased which also increased which also increased the yield (F. and Asseng, 2005).

less soil moisture and increased temperature grain filling was difficult. Every year +2 and -2 changed in average global temperature is affecting in wheat production upto 50%. When temperature was at 34^{o}c leaf senescence increased. Temperature conditions during grain filling were like Australia's conditions. Average temperature and heat is increasing the global warming due to which yield is decreasing due to more temperature during grain filling stage (Asseng et al., 2010).

Eight varieties were evaluated for heat tolerance, sensitivity and to know the specific variety for optimum sowing time. Bijoy, sufi, shatabdi, Gourab, Sourav BARI Gom-26, BARI Gom-25 and prodip were sown at three different sea levels such as 25^{o} 38N, 88^{O} 41E and 38,20m. Varieties were sown at 8, 15, 22, 29 November and on 6, 13, 20 and 27 December. Varieties were better which were sown from 22 Nov to 20 December instead of which were sown at 8, 15 November and on 27 December. Shatabdi was best according to sowing performance. In more heat stress from Nov 8-27 Dec Prodip was heat sensitive. Yield decreased upto 28.92% and

41.18%. In BARI Gom 26 yield decreased upto 41.15% and 22.73%. At early and late stress Sourav and BARI 25 were heat tolerant. Sourav variety showed decreased in yield upto 20.47% when sown at Nov-8 whereas in Gom-25 yield decreased upto 27.91% and in late sowing of 27 December Sufi was best, yield decreased upto 8.60% and in Bijoy 11.05% (Hossain et al., 2011).

Different temperature was provided from Sep-May. Yield loss was more at freezing temperature and at extreme heat of spring. Warming had a negative effect on yield. Average yield in varieties were related with the resistance against extreme heat. When in spring, rainfall was more released varieties showed less resistance against heat instead of old varieties (Tack et al., 2014).

Spring wheat was sown into 3 consecutive seasons in Free air CO_2 Enrichment (FACE) to check their effect on crop yield and grain quality. CO_2 Enrichment increased the grain yield 10.4% and above biomass upto 11.8% whereas on grain quality it had adverse effects. 1000 grain weight remained same and grain size decreased. Total grain concentration decreased upto 7.4%. Under elevated CO_2 Amino acid and protein altered. Whereas by CO_2 enrichment grain protein concentration decreased due to which amino acid decreased and non-essential amino acids decreased more. Potassium, molybdenum and lead increased whereas manganese, iron, cadmium and silicon decreased. Fructose, Fructan and carbohydrates significantly increased instead of starch. Under elevated CO_2 resistance was noticed against gluten. CO_2 enrichment affected the grain quality which was better according to nutritional point of view (P et al., 2009).

Wheat was scaled from 0-5 according to black point infection which was produced from Bipolaris Sorokiniana. Quality characters such as protein, fat, dry matter ash and Mineral contents were graded. Dry matter and grain ash contents decreased whereas protein and fat increased at increased level of Black point infection. At increased level nitrogen Phosphorous, calcium, magnesium, Sulphur and boron increased whereas potassium, iron, zinc, copper and sodium decreased so much in effected grains as compared to healthy one (MALAKER et al., 2009).

Effect of leaf rust in Karl hard red winter on grain quality, milling properties, flour protein content and on peak mixing time was observed. In one disease was controlled and on other fungicide was applied, deviation was observed for single kernel size. Crop which was provided with fungicide had increased flour protein content and grain increased up to 0.7% (Herrman et al., 1996).

Cultivars to check the effect of powdery mildew on quality was used by (Samobor et al., 2006). Cultivars which were untreated had less kernel weight and less grain protein up to 0.5% and 1.01kg/hl. At treated and untreated there was no difference in wet gluten content and sedimentation value was more in untreated. Dough development, stability, resistance and degree of softening all were better in untreated. Dough yield was more in treated whereas volume distribution was more in untreated. In moderately infected, untreated and susceptible quality parameters were better which proved that epoxiconazole 12.5 + Carbendazim 12.5 had negative side effects.

Intensive management was done to increase the grain yield which caused lodging. Lodged wheat gave 1,440kg/ha yield which was less as compared to standing. Test weight of lodged was 6kg/hl and had low milling score, low flour yield, increased ash in flour, increased water absorption caused low milling score. Flour products made from lodged had less diameters whereas as standing had more diameter (Pumphrer and Rubenthaler, 1983).

Wheat varieties Dera-98, Daman-98, Nasir-2k, Raj, Zam-04 and Hashim for yield and yield parameters in lodged conditions and in normal crop stand in Pakistan were evaluated. They showed significant differences for grain/spike, weight/spike, grain yield and for 1000 grain weight in both conditions. Daman-98 showed more grains/spike, increased grain weight/spike and more grain yield. In Dera-98 more effects of lodging was observed (Khakwani et al., 2010).

Wheat variety (kohdasht) at 4 nitrogen levels was sown. 453mm precipitation, no nitrogen, 30 N_1, 60 N_2 AND 90 N_3 kg/ha was provided. Agronomic traits and yield components were positively influenced by nitrogen. Increased nitrogen from 60-90kg/ha did not affect the characters so much (Fallahi et al., 2008).

Quality of wheat depends upon environment, genotype and their interaction. 18 genotypes were sown at 6 locations in Nebraska and Arizona. Harvested grains were milled to know about low protein mixing characteristics and sodium dodecyle/sulphate sedimentation. Kernel hardness was founded by microscopic evaluation. Environment effected more the quality characters. Genotype and Genotype x Environment interaction affected same the tolerance and kernel hardness but their effect on SDS, mixing time and flour protein concentration was less. Location had also impact on quality (Peterson et al., 1991).

Glutenins and gliadians are major components in protein storage, dough rheology and in baking quality. Quality differences are important in these proteins especially for glutenins. In 15 environments 7 cultivars were sown by Panozzo and Eagles (2000). In flour protein glutenin was depended upon cultivar whereas for gliadin environment proved more important. For dough rheology environment proved important. Gliadin proportion increased as flour protein increased whereas glutenin decreased. Temperature more than 30°c in 14 days after anthesis increased the gliadin and to some extent decreased the glutenin. Ramax, dough development time and more rapid dough break down was also related to this cultivar which contained Glu-D1a Allele had more Ramax at increased temperature. This proved that performance of cultivar with different alleles which were present on their locus depends upon environment.

In Mediterranean climate effect of nitrogen fertilisation and their timing were different on 5 wheat cultivars. Their effect on bread making quality was different at 6 different sites. Nitrogen was given at 2 rates at each location. First increased the yield and second increased yield up to 30%. Different timings of nitrogen were checked also late application at boot stage was included. In northern location grain yield was more 7.1t/h and was low in south 2.6t/ha whereas in Sicily under rainfall yield was 6.41t/ha. Bread making quality was more in northern location. Year of cultivation also affected the quality, gluten whereas at locations quality and ranking of all cultivars remained same. Nitrogen application increased the yield and bread quality (Borghi et al., 1997).

Above 35°C post anthesis temperature decreased the grain yield and quality. Cultivars were screened for 3 days at 40°C. Individual kernel mass depended upon variety and decreased up to 23%. Gliadin and glutenin ratio was-9 to +18% by increased temperature by depending upon variety. Heat effected quality but significant change in amylose for any cultivar was not observed. Starch and protein synthesis was affected by heat stress and it was not immediately recoverable. Grain yield and quality at increased temperature showed tolerance said by Stone and Nicolas (1994).

Pre-harvest sprouting decreased the quantity and quality of wheat grain. 10 spring genotypes were observed that which temperature had more effect on seed germination and expression of seed dormancy (Nyachiro et al., 2002). Seed samples were harvested at 25% moisture content and 12% dry content. Weighted germination index was less in most genotypes. A difference was observed in seed germination when temperature was 15-20°C. Seed dormancy was depended on genotype and germination on temperature.

Response of 4 cultivars on NaCl salinity for germination and for early seedling growth was observed. Salinity treatments 0.00, -2.457, -4.914, -9.828 and -14.742 were achieved by dissolving NaCl into deionized water. All cultivars had less water uptake and germination. Salt concentration effected the early seedling growth (Wardlaw et al., 2002). Zarlasht cultivar proved more sensitive at germination stage whereas at seedling stage performed best.

Effect of temperature more than 20°C and more than 32°C heat shock on wheat yield and quality was observed. Heat shock was given by changing duration. 2 cultivars Trigo 1 and Lyallpur both showed decreased in weight kernel above 18°C whereas Trigo 1 proved more tolerant. Kernel weight of both also effected by short period of heat shock at day temperature of 30/25°C. Both showed change in Dough strength at high temperature and heat shock. Trigo 1 resisted these change more. Heat decreased the molecular size of Glutenin which decreased the dough strength. Whereas this did not much affect the flour protein content (Blumenthal et al., 1991).

27 years trials at 3 sited of 5 varieties on different temperature profiles during grain filling period before 50 days of harvesting to see the effect of temperature was compared. Heat stress was more at 2 sites. At 3rd sites spring temperature was moderate. Heat stress at 35°C had positive effect on protein content during grain filling, negative with grain yield in all varieties in Narrabi. At some sites heat shock had negative co-relation with loaf volume and dough strength. At late stage of grain filling higher temperature produced weaker dough property of grain (Rahman et al., 2008).

Drought is an important factor in plant production. Study was made at clay silt soil in Diyarbaki to see the effects on yield, yield component and on quality traits by Kilk and Yagbasanlar (2010). 14 wheat cultivars were sown in natural conditions and in irrigation. Morphological traits were sown in natural drought conditions and in irrigation. Morphological traits were seen at anthesis and at ripening stage yield, components and quality traits were seen. Flowering period was negatively associated with grain yield, grain filling period, chlorophyll content, grains/spike and spikelets/spike and was positively with grain yield. In drought days to maturity was negatively associated with drought susceptibility index (DSI). Spike length was positively associated with DSI in drought condition. DSI which was relative of grain yield used to see yield stability and yield potential. In genotypes there was variation between DSI and RY values. DSI for grain yield was 0.82-1.07, mean RY was 0.8 under water conditions and 0.87 under drought conditions. Giadara-II, Aydin-93, Harran-95 etc. had more yield potential, RY>Mean RY & DSI < 1.

Two-third ends of spikes were tapered by late frost in winter wheat in Newzeland. Grains of effected spikes were 80% weak. Upto 13-33% crop was affected. In healthy grains pericarp and testa were compressed whereas in effected they were loosely compressed. Aleuron layer was also not in order and starchy endosperm was also not so much changed.

Expansion of testa cells and pericarp caused rehydration. Whereas normal cells showed expansion. Blisters were observed in grains whereas outer layer was detached from the pericarp (Cromey et al., 1998).

Effect of boron and zinc on yield and yield components of wheat in NWFP, Pakistan from 2004-2005and 2005-2006 was observed. Water and no spray were given as a control measure. In both season there was significant increase in spikes/m, grains/spike, 1000 grain weight, biological yield and grain yield which were given boron and zinc as compared to control measures. Combined boron and zinc application gave increased grains/spike (56 in 2004-05 and 48.5 in 2005-06), 1000 grain weight (52.2 as mean over year), biological yield (8754kg/ha from 2004-05 and 11389kg/ha from 2005-06) and grain yield was (2833kg/ha from 2004-06 and 2555kg/ha from 2005-06). Water application and no spray decreased all the traits. It showed that boron and zinc increased the production (Ali et al., 2009).

Wheat is the utmost significant cereal crop of world's population. It is staple food for two billion people. It offers calories and carbohydrates in large amount. It surpasses in production every other grain crop and is cultivated over an extensive range of climatic circumstances. That's why it has more impact of climatic changes and agricultural practices on its quality and yield. Global climate change has an effect on world food security. It has effect on every growth stage. Heat stresses, pre-anthesis effects, temperature, warming and G X E all have more effect on yield and quality. There is need of strategies to predict the impacts on yield so that we can take the measures efficiently to avoid yield loss. There is need to improve the agricultural practices to improve the grain quality standard and yield by applying these practices according to climatic features.

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References:

1. Abedi T, Alemzadah A, Kazemeini SA. Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. Australian Journal of Crop Science 2010;4(6): 384-389.
2. Ahmed M, Ghaffoor A, Asif M, Farid HU. Effect of irrigation techniques on water production and water saving in soils. Soil and Environment 2010;29(1): 69-72.
3. *Alam SM.* Wheat - An important edible crop of Pakistan. Industry and economy 2001:51-52.
4. Ali A, Ahmed A, Syed WH, Khaliq T, Asif M, Aziz M, Mubeen M. Effects of nitrogen on growth and yield components of wheat. Sci.Int. 2011;23(4):331-332.
5. Ali et al. (2009). Enhancement of wheat grain yield and yield components through foliar Application of zinc and boron. Sarhad J. Agric. 25(1): 15-19.
6. Ali L, Mohy-un-DN Q, Ali M. Effect of Different Doses of Nitrogen Fertilizers on the Yield of Wheat. International journal of agriculture & biology 2003;1560-8530:05-4-438-439.
7. Altenbach SB, Dupant FM, Kothari KM, Chan R, Johanson EL, Lierr D. Temperature, Water and Fertilizer Influence the Timing of Key Events During Grain Development in a Us Spring Wheat. Journal of Cereal Science 2001;37:9-20.
8. Ashfaq M, Zulfiqar F, Sarwar I, Quddus MA. Impact of climate change on wheat productivity in mixed cropping system of Punjab. Soil Environ. 2011;30(2):110-114.
9. Asseng et al. (2010). The impact of temperature variability on wheat yields. Global Change Biology 17(2): 997-1012.
10. Asseng S, Milory SP. Stimulation of environmental and genetic effects on grain protein concentration in wheat. Europ. J. Agronomy 2006;25:119-128.
11. Blumenthal CS, Bekes F, Batey IL, Wrigley CW, Moss HJ, Mores DJ, Barlow EWR. Interpretation of grain quality results from wheat variety trials reference to high temperature stress. Australian Journal of Agricultural Research 1991;42(30):325-334.
12. Borghi B, Corbellini M, Minoia C, Palumbo M, Fonzo ND, Perenzin M. Effects of Mediterranean climate on wheat bread-making quality. European journal of agronomy 1997;6:145-154.
13. Brill R. Effect of anthesis on grain yield and yield components of wheat- Trangie 2009-2012. Building Productive, Diverse and Sustainable Landscapes 2015.
14. Chaudhary SU, Hussain M, Ali MA, Iqbal J. Effect of weed composition on yield and yield components of wheat. J Agric Res. 2008;48(1).
15. Cromey MG, Wright DSC, Buddington HJ. Effects of frost during grain filling on wheat yield and grain structure. New Zealand Journal of Crop and Horticulture Science (1998);26(4).
16. Daniel, C., Triboi, E., 2001. Changes in wheat protein aggregation during grain development: effect of temperature and water stress. European journal of Agronomy 16, 1-12.
17. Dimmock JPRE, Gooding MJ. The effects of fungicides on Hagberg falling number and

blackpoint in winter wheat. Crop protection 2001;21:475-487.
18. F. L, Asseng S. Impacts and Adaptations to Climate Change in Western Australian Wheat Cropping systems. CSIRO Plant industry 2005.
19. Fallahi HA, Nasseri A, Siadat A. Wheat Yield Components are Positively Influenced by Nitrogen Application under Moisture Deficit Environment. Int. J. Agri. Biol. 2008;10: 673-6.
20. Gifford RM. Whole plant respiration and photosynthesis of wheat under increased CO_2 concentration and temperature: long term vs. short-term distinctions for modeling. Global Change Biology 1995;1: 385-396.
21. Gooding MJ, Ellist RH, Lookhart GL, Shewry PR, Schofield JD. Effects of Restricted Water Availability and Increased Temperature on the Grain Filling, Drying and Quality of Winter Wheat. Journal of Cereal Science (2002); 37: 295-309.
22. Guan D, Zhang Y, Al-Kaisi MM, Wang Q, Zhand M. Tillage practices effect on root distribution and water use efficiency of winter wheat under rain-fed condition in the North China Plain. Soil & Tillage 2014;146:286-295.
23. Herrman YJ, Bowden RL, Loughin T, Bequette RK. Quality Response to Control Leaf rust in Karl Red Winter Wheat. Cereal chemists 1996;73(2): 235-238.
24. Hossain A, Sarkar MA, Lozovskaya MV, Zvolinsky VP. Effect of temperature on yield and some agronomic characters of spring wheat (Triticum aestivum l.). Int. J. Agril. Res. Innov. & Tech. 2011;1(1&2): 44-54.
25. Hurkman WJ, Vensel WH, Tanaka CK, Whitehand L, Altenbach SB. Effect of high temperature on albumin and globulin accumulation in the endosperm proteome of the developing wheat grain. Journal of Cereal Science 2008;49, 12-23.
26. Irmak S, Naeem HA, Lookhart GL, Macritchie F. Effect of heat stress on protein during kernel development in wheat near-isogenic lines differing at Glu-Dl. Journal of Cereal Science (2007);48:513-516.
27. Ivanova A, TSENOV N. Effects of some agronomy practices on main traits of grain yiel in winter wheat varities of different quality. Bulgarian Journal of Agriculture Science 2010;16(5):559-564.
28. Khakwani AA, Baloch MS, Nadim MA, Zubair M, Shah IH, Khan AW. Lodging: A determination factor in reducing yield and yield structures of wheat. Sarhad J. Agric. 2010;26(2): 235-239.
29. Kilic H., Yagbasanlar T. The Effect of Drought Stress on Yield Components and Some Quality Traits of Durum Wheat (Triticum turgidum ssp. Durum) cultivars. Not. Bot. Hort. Agrobot. Cluj 2010;38(1):164-170.
30. Kimball BA, Morris CF, Jr PJP, Wall GW, Hunsaker DJ, Adamsen FJ, Lamorte RL, Leavitt SW, Thempson TL, Matthias AD, Brooks TJ. Elevated CO_2, drought and soil nitrogen effects on Wheat grain quality. New phytologist 2001;150:295-303.
31. Malaker PK, Mian IH, Bhuiyan KA, Reza MMA, Mannam MA. Effect of black point disease on quality of wheat grain. Bangladesh J. Agril. Res. 2009 ;34(2):181-187.
32. Nyachiro JM, Clarke FR, Depauw RM, Knox RE, Armstrong KC. Temperature effects on seed germination and expression of seed dormancy in wheat. Euphytica 2002;126(1):123-127.
33. Ozturk A, Aydin F. Effect of Water Stress at Various Growth Stages on Some Quality Characteristics of Winter Wheat. J. Agronomy and Crop Science 2003;190:93-99.
34. P H, H W, P K, K S, J B, J F, R M, A F. Effects of elevated CO_2 on grain yield and quality of wheat: results from a 3-year free-air CO_2 enrichment experiment. Plant boil 2009;1: 60-9.
35. Panozzo JF, Eagles HA. Cultivar and environmental effects on quality characters in wheat. II. Protein. Australian Journal of Agricultural Research 2000;51(5): 629-636.
36. Peterson CJ, Graybosch RA, Gronbacher AW. Genotype and Environmental Effects on Quality Characteristics of Hard Red Winter Wheat. CS 1991;32(1):98-103.
37. Pierre CS, Peterson CJ, Ross AS, Ohm JB, Verhoeven MC. Winter wheat genotypes under different levels of nitrogen and water stress: Changes in grain protein composition. Journal of Cereal science (2007);47:407-416.
38. Pumphery, FV, Rubenthaler GL. Lodging Effects on Yield and Quality of Soft Winter Wheat. Cereal Chemistry 1983;60(4):268-270.
39. Punta DE. Second Global Conference on Agriculture Research for Development. Breakout session P1.1 National Food Security – The Wheat Initiative – an International Research Initiative for Wheat Improvement 2012.
40. Rahman MU, Soomro UA, Zahoor-ulHaq M, Gul S. Effects of NaCl Salinity on Wheat (Triticum aestivum L.) cultivars. World Journal of Agriculture Sciences 2008;4(3): 398-403.
41. Rehman S, Khalil SK, Rehman A, Saljoqi AUR. Organic and inorganic fertilizers increase wheat yield components and biomass under rainfed condition. Sarhad J. Agric. 2008;24 (1).

42. Sambor V, Vukobrantovic M, Jost M. Effect of powdery mildew attack on quality parameters and experimental bread baking of wheat. Acta agriculture Slovenica 2006;87:381-391.
43. Schapendock AHCM, XV HY, Putten PELVD, Spiertz JHJ. Heat-shock effects on photosynthesis and sink-source dynamics in wheat (Triticum aestivum L). NJAS 2007;55-1.
44. Smith, GP, Gooding, MJ. Models of wheat grain quality considering climate, cultivar and nitrogen effects. Agriculture and Forest Meteorology 1999;94:159-170.
45. Spiertz JHJ, Hamer RJ, XU H, Martin CP, Don C, Putten PELVD. Heat stress in wheat (Triticum aestivum L.): Effects on grain growth and quality traits. Europ. J. Agronomy 2006;25: 89-95.
46. Stone PJ, Nicolas ME. Wheat Cultivars Vary Widely in Their Responses of Grain Yield and Quality to Short Periods of Post-Anthesis Heat Stress. Australian Journal of Plant Physiology 1994;21(6):887-900.
47. Tack J, Barkley A, Nalley LL. Effect of warming temperature on US wheat yields. PNAS 2014;112(22): 6931-6936.
48. Tonkaz T, Dogan E, Kocyigot R. Impast of temperature change and elevated carbon dioxide on winter wheat (Triticum aestivum l.) grown under semi-arid conditions. Bulgarian Journal of Agricultural Science 2010;16(5):565-575.
49. Triboi E, Abad A, Michelena A, Lloveras J, Ollier JL, Dauiel C. Environmental effects on the quality of two wheat genotypes: 1. quantitative and qualitative variation of storage protein. European Journal of Agronomy 2000;13:47-64.
50. Triboi E, Martre P, Girousse C, Ravel C, Blondel AMT. Unraveling environmental and genetic relationships between grain yield and nitrogen concentration of wheat. Europ. J. Agronomy 2006;25:108-118.
51. Wardlaw IF, Blumenthal C, Larroque O, Wrigley C. Contrasting effects of chronic heat stress and heat shock on kernel weight and flour quality in wheat. Functional Plant Biology 2002;29(1):25-34.
52. Wieser H, Seilmeier W. The Influence of Nitrogen Fertilisation on Quantities and properties of Different Protein types in Wheat Flour. J Sci Food Agric 1997;76: 49-55.

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