Department of Genetics and Plant Breeding

School of Agriculture

# Assessing Stability Performance of Wheat (Triticum aestivum L. em Thell.) Hybrids for Yield and Yield Contributing traits under Different Environmental Condition

**Synopsis for Research Project of**

**M.Sc Agri. (Genetics and Plant Breeding)**

**On**

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**Department of Genetics and Plant Breeding**

**In partial fulfillment of the requirement**

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**Uni. Regd. No. 11718100**

## Title:

**Assessing Stability Performance of Wheat (Triticum aestivum L. emThell.) Hybrids for Yield and Some Yield Components under Different Environmental Condition**

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| **Period of Research** | **:** | **2017-2019** |

# CERTIFICATE

This is certified that this synopsis entitled "**Assessing Stability Performance of Wheat (Triticum aestivum L. em Thell.) Hybrids for Yield and Yield Contributing Traits under Different Environmental Condition"** submitted in partial fulfilment of requirements for degree – **Master of Science in Genetics and Plant Breeding** by **Swapnil Kalubarne**, Registration no. **11718100** to **Department of Genetics and Plant Breeding, School of Agriculture, Lovely Professional University**, has been formulated and finalized by the student himself on the subject.

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# DECLARATION

I hereby declare that the project work entitled — "**Assessing Stability Performance of Wheat (Triticum aestivum L. emThell.) Hybrids for Yield and Yield Contributing Traits under Different Environmental Condition"** is an authentic record of my work carried at **Lovely Professional University** as requirements of Project work for the award of degree -**Master of Science in Genetics and Plant Breeding**, under the guidance of **Dr. Nidhi Dubey, Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab**

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# Content

# 1. INTRODUCTION

Wheat (Triticum aestivum L. em Thell.) is the most important cereal crop of the world. It has been described as the "King of cereals" because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. Wheat variety is a self-pollination annual plant in the true grass family Gramineae (Poaceae).There are many type of wheat. These are Emmer wheat (Triticum dicoccum), Macaroni wheat (Triticum durum), Common bread wheat (Triticum vulgare), Indian dwarf wheat (Triticum spherococcum) and last one is Bread Wheat (Triticum aestivum). Triticum aestivumis heaxalpoid (2n=6x=42).

Punjab (the five rivers region) the most fertile region of the earth. The region is ideal for growing wheat crop. First highest wheat production state is Uttar Pradesh 25220 tonnes and second Punjab is 15783 tonnes. India total wheat cultivation area is 9.85 million hectares and Punjab state total wheat area cultivation is 4.20 million hectares (about 83%). Total wheat production in India recent year 2017 is 98380 mt and growth rate is 13.08%. India is the third rank in world wheat production (87000 mt).

Heterosis and combining ability analysis were studied in a 8 × 3 (line X tester) set of bread wheat. Analysis of variance (ANOVA) revealed the presence of significant variance due to general combining ability (GCA) among the parents for all the traits, and due to specific combining ability (SCA) among the crosses. Combining ability analysis is the best technique for the proper choice of the parents for improving specific traits as well as the breeding value of the genetic variability which can be successfully used in future hybridization programs. Significant levels of heterosis have been reported in a number of self-pollinated crops, and were first observed in wheat by Freeman (1919). In wheat there are several reports on combining ability and heterosis (%) using $F_1$ generation.

Keeping in view the aforesaid problems, the present investigation has been planned with following objective;

**OBJECTIVE:**

1. To study *per se* performance of parents vs Hybrids.
2. To find out genotype into environmental interaction and identification of stable genotype.
3. To study the heterosis for yield and gene action for its component.
4. To study general and specific combining ability effects to identify best combiners for yield and its component.

# 2. REVIEW OF LITERATURE

The success of any plant improvement programme mainly depends on the right selection of the material and its skillful management. It is only possible when we possess knowledge of previous work done in concerned field. In wheat substantial contribution has been made to the literature regarding its Genetics and Breeding in the recent years. The literature related to the various aspects of the parent study has been reviewed under the following heads;

2.1 Genotype into environment interaction and identification of stable genotype.

2.2 Heterosis analysis.

2.3 General and specific combining ability effects to best combiners for yield and its component.

## 2.1 GENOTYPE INTO ENVIRONMENT INTERACTION

Genotype into environment interaction is major factor to decide crop yield. Genotype into environment interaction is directly or indirectly affects the crop yield.

**Naheif et. al., (2013).** The combined ANOVA analysis for grain yield of ten wheat genotypes at 12 environments showed that bread wheat grain yield was significantly affected by environment, which explained 75.01% of the total treatment (genotype + environment + genotype by environment interactions) variation, whereas the G and GEI were significant and accounted for 9.48 and 15.5%, respectively.

**Madariaga et. al., (2012).** They necessary to know and define the environments which variety can express its maximum potential yield and quality. The objective of this study was to assess which method is the most efficient to study cultivars response in multiple environments. For this, we analyze the adaptability, stability and genotype × environment (G×E) interaction effect, grain yield, sedimentation, and wet gluten content of 13 spring wheat cultivars sown in six environments in the central-south and southern zones of Chile during two seasons. The data were analyzed by regression analysis, additive main effects and multiplicative interaction (AMMI), and the sites regression (SREG) model. In this case, 'Pandora-INIA' stands out by exhibiting the best yield (7.38 t ha-1), high sedimentation (36.95 cm3), and wet gluten (41.54%) indices in all the environments, and this positions it as a variety having both high yield and quality.

**Ichinkhorloo_et. al., (2003).** The interaction of genotype and environment upon yield and quality parameters of eight winter wheat genotype was studied under organic condition under Austria over two growing periods. Two sites that have different climatic condition. To produce seed to better and high yield that's why we should choose suitable climatic site.

## 2.2 HETEROSIS ANALYSIS

**Noorka et. al., (2013).** Estimate the relationship between F1 hybrids and their parents under water stress regime only. The presence of significant grain yield was also accompanied by heterosis for yield components, particularly length based traits such as plant height, spike length and peduncle length. The study suggest that the obtained hybrids surpassed their better parents ,effects, indicative of commercial heterosis and thus candidates for commercial production of hybrid wheat

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**Koumber et. al.,(2012).** Three crosses were used among five parental varieties, namely P1 x P2 (1), P3 x P4 (2) and P4 x P5(3) five populations (P1, P2, F1, F2 and F3) for each cross were used in this investigation. Highly significant heterotic values in positive direction were found for all characters except for plant height and 1000-grain yield in the first cross, spike length in the second cross and plant height, No. of grains/spike and No. of spikes/plant in the third cross. Over domenance for all characters except plant height and 1000-grain weight in the first cross, spike length in the second cross and No. of grains /spike in the third cross was detected. The important roles of both additive and non-additive gene action were found in certain studied traits. High to medium values of heritability estimates were found to be associated with high and moderate expected and actual gain in most traits. These obtained results indicated that, these traits could be used in the early generations, but would be more effective if postponed to late generations.

**Kumar et. al., (2015).** Revealed the presence of significant variance due to general combining ability (GCA) among the parents for all the traits, and due to specific combining ability (SCA) among the crosses for the all the traits except for number of tillers per plant, plant height and number of spikelets per spike. Combining ability analysis revealed the involvement of both additive and non additive gene action in the inheritance of most of the traits. On the basis of GCA, SCA effects and per se performance, parents K 9107 for 6 traits, K 9162 for 4 traits and GW 373 for 3 traits and crosses K 9107 × K 7903 for 2 traits, K 68 × K 7903 for 2 traits were found good general and specific combiners, respectively. Significant heterosis over economic parent and mid parent was observed for almost all the traits studied. The magnitude of heterosis was highest (21.74%) for number of spikelets per spike over economic parent and for number of tillers per plant (13.73%) over mid parent.

## 2.3 GENERAL AND SPECIFIC COMBINING ABILITY

**Jatav et. al., (2017).** The GCA and SCA components of variances in both generations showed significant for all traits indicating additive and non additive gene action controlled the pattern of inheritance for the concern traits over the both generations. Based on the general combining ability effects and *per se* performance, parent K 0307 and K 0911 emerged as good general combiners for grain yield. Whereas K 0307 showed also good general combiner as their gca effect as well as *per se* performance for number of spikelets, number of grains per spike, grain weight per spike, spike length, 1000 grain weight while K 0911 exhibited good general combiner for protein content based on per se performance and GCA effect in both generations. On the basis on *per se* performance and sca effects, DBW 14 x K 0424 and K 9533 x K 0307 possessed good super combinations for grain yield and its related components whereas, K 0607 x K 0307 exhibited good cross combination for protein content based on their *per se* performance in both generations.

**Kumar et. al., (2017).** They studied ten diverse parents and their 45 F1s and their F2s indicated significance differences among the parents for gca and crosses for sca for all characters under studied. The GCA and SCA components of variances in both generations showed significant for all traits indicating additive and non additive gene action controlled the pattern of inheritance for the concern traits over the both generations. Based on the general combining ability effects and *per se* performance, parent K 0307 and K 0911 emerged as good general combiners for grain yield and average to high combiners for almost of the yield component characters in late sown condition, it means these genotypes probably possessed the desirable genes for heat temperature during reproductive phase. Additive as well as non-additive components were prevalent for the control of grain yield and its components under both water stress and non-stress environments except spike length in under stress environment.

**Kamaluddin et. al., (2007).** A diallel analysis of wheat (Triticum aestivum L. em. Thell) parents (n = 11) and their F1 (n = 55) and F2 (n = 55) offspringwas carried out for the following four traits: grain filling duration (GFD), GFD for growing degree days (GDD),1000 seed weight and seed yield per plant. Analysis of variance for general combining ability (GCA) and specific combining ability (SCA) displayed significant F1 and F2 general and specific combining ability effects for the four traits studied. For all the traits the GCA effects were relatively more important than the SCA effects, indicating that additive genetic effects were predominant. Crosses displaying high SCA effects for grain filling duration, seed weight and yield were observed to be derived from parents having various types of GCA effects (high x high, high x low, low x low and medium x low).

## 3. MATERIAL AND METHOD:

The experimental material of present study comprised of 24 hybrids developed from line into tester mating design (8x3). The crosses were made during rabbi season 2017-18 by line into tester mating design which will be evaluated during rabbi season 2018-19 along with parents at field of Lovely Professional University, Phagwara, India.

### 3.1 EXPERIMENTAL DETAIL

**1ST Season (crossing)**

| | | |
|---|---|---|
| Crop | : | Wheat |
| Mating design | : | Line x Tester |
| Genotype | : | Different Variety of wheat |
| Parent | : | 11 (Line 8 and Tester 3) |
| Experimental year | : | 2017-18(crossing),2018-19 (evaluation) |
| Row to Row distance | : | 20cm |
| Season | : | *Rabi* |

**2nd sowing (evaluation)**

| | | |
|---|---|---|
| Number of genotype | : | 35(hybrid 24, parent 11) |
| Design | : | RBD Randomized Block Design) |
| Replication | : | 3 |
| Environment | : | 3 (Normal, Late, Very Late) |

## 3.2 GENOTYPE DETAIL

| Sr. No. | Genotype | Pedigree/ Source |
|---|---|---|
| | **Line** | |
| 1 | DBW-107 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 2 | RUJ-4037 | DL 788-2/RAJ 3717 |
| 3 | DBW-90 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 4 | DBW-93 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 5 | DBW-88 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 6 | WH-703 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 7 | DBW-110 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| 8 | PBW-677 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |
| | **Tester** | |
| 1 | PBW-343 | ND/VG9144//KAL/BB/3/YCO"S" /4/VEE#S "S" |
| 2 | MP-3336 | HD2402/GW173 |
| 3 | MP-3382 | INDIAN INSTITUTE OF WHEAT AND BARLEY RESEARCH KARNAL |

## 3.3 STATISTICAL ANALYSIS

1. Analysis of variance(Panse and sukhatme, 1952)
2. Estimation of heterosis ( Fonseca and patterson 1968)
3. Combining ability analysis (Line x Tester analysis: Kempthorne, 1957).
4. Stability analysis AMMI model (Gauch 1988

## 3.4 Collaboration with other Departments:

Indian institute of wheat and Barley research, kernel, Haryana (IARI Regional Research Station)

## 3.5 OBSERVATIONS:

| A | Quantitative traits | B | Physiological Traits |
|---|---|---|---|
| 1 | Days to 50% heading | 14 | Canopy temperature |
| 2 | Days to maturity | 15 | Chlorophyll content |
| 3 | Plant height (cm) | **C** | **Quality Traits** |
| 4 | Number of productive tillers plant$^{-1}$ | 16 | Protein content (%) |
| 5 | Number of spikelets ear$^{-1}$ | | |
| 6 | Ear length (cm) | | |
| 7 | Ear weight (g) | | |
| 8 | Number of ears plant$^{-1}$ | | |
| 9 | Number of grains ear$^{-1}$ | | |
| 1 0 | 1000-grain weight (g) | | |
| 1 1 | Biological yield plant$^{-1}$ (g) | | |
| 1 2 | Grain yield plant$^{-1}$ (g) | | |
| 1 3 | Harvest index (%) | | |

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