MATERIALS AND METHODS
Materials And Methods

Breeding new varieties for high yield has been a continuous process. As most of the newly introduced varieties showed full potential on the background of modern techniques employed in the fields. The farmers were benefited economically by the adoption of technologies recommended, however in the face of ongoing technology changes from time to time, new problems were experienced particularly in use of agrochemicals which tend to alter the physiology of the crop.

The certified proven varieties were grown for their promising attributes in the experimental trials conducted at Nanded. The practices recommended such as variety, sowing method, irrigation, fertilization, and weed control measures were strictly followed. The field observations revealed that the growth of the crop largely depended on cultivation methods and nutrients when provided in balance, different varieties attain full potential that ensured yield maxima.

The major aspects of study in this thesis is to find out the effect of herbicides since, weeds present intricate problems. Their presence slows down crop growth, makes grain harvest difficult and unless they are checked, it is pointless to pile up on other inputs until these factors are taken care of.

With these objectives, five herbicides were selected at four sub lethal concentration doses on two semidwarf wheat varieties. The experiments were conducted
to study the genotypic responses in terms of biometric and physiological parameters.

To assess the growth and physiological attributes which contribute to yield under the influence of different sub-lethal concentrations at different physiological stages of the crop. Several experiments were conducted.

**Site**

The experiments were conducted at Science College campus, Nanded in the rabi season for two years.

**Soil**

The land was fairly leveled and uniform in topography. It was medium in depth about 90 cm and clayey in texture. In general the fertility status was low in nitrogen, medium for phosphorous and high in potassium. Soil reaction was slightly alkaline. (pH 7.8 to 7.9).

**Experimental Details:**

a) Two genotypes of wheat viz. H.D. 2838, H.D. 1555 were tested in the present investigation in the year 1988-89, 1989-90 in rabi season under the package of practices as suggested by the state government.

b) Five herbicides presented as gift samples were taken for study in four concentrations

1) Velpar (Hexazinone) (H₁)
2) Gesagard (Prometryne) (H₂)
3) Sinbar (Terbacil) (H₃)
4) Simazine (2-Chloro-4-6-Ethylamino-1,3,5-Triazine) (H₄)
5) Atrazine (2-chloro-4-Ethylamino-6-Isopropylamino -1,3,5 Triazine-2-4-diamine)
c) Design: Factorial Randomized Block Design.

d) Replication: Two

e) Plot Size: Gross 7.2 m x 6.0 m

f) Treatment Combinations:
   1) Varieties: Two
   2) Herbicides: Five
   3) Concentrations: Four

The details of the field operations done and inputs used are given in Table 1. The sowing, interculturing operations, application of herbicidal doses of different concentrations, C1-C3 at five different physiological ages of crop and sample harvesting are presented in the same Table 1.

The following observations were recorded on different parameters.

1) Weed Count/m²: - Was taken by applying transact Quadrat method, at 20 and 40 days after sowing. After the count of weed flora, the dry matter weights were determined at 98°C ± 2°C in oven maintained constant for 24 hours.

2) Plant Height: - 5 plants were randomly selected from each net plot, the plants were tagged properly and periodical observations on plant height were recorded at five physiological stage of the crop viz., maximum tillering stage, flag leaf stage, boot, milk and dough stage and at harvest.

3) No. Of Tillers/Plants: - This observation was taken on the randomly selected and tagged plant samples referred to above at all the five physiological ages of the crop.

4) Dry Matter Studies: - Another five randomly selected
plants from each net plot were harvested at the five physiological ages of the crop. The roots were cut and detached. The plant samples were air dried and then removed to oven at 98 °C temp. for 24 hours, the dry weights were taken and recorded as TDM.

5) **Plant Nitrogen and Crude protein** :- The samples used for DM studies were processed to fine powder, passed through mesh and N was determined by using microKjeldahl method modified by Byres and Sturrock (1945).

CP (Crude protein) was estimated by multiplying N% x 5.75

A O A C (Association of official Agricultural Chemists: 74)

6) Observations on number of spikelets/spike, and number of grains/spike were recorded at harvest on the 5 randomly selected plants.

7) Grain CP was estimated by determining N% in grain from harvested sample (microKjeldahl) multiplying by N% x 5.7

8) Protein N in leaf extract.

9) 1000 grain weight

10) Grain yield

11) Grain CP%

**Protein N% In Leaf Extract :** At all stages in both years protein and carbohydrate was determined in developing grain at 4 stages.

Leaves samples at 7 days interval at all stages of crop growth were pulped in power driven meat mixer. The pulp obtained was subjected under uniform pressure to collect leaf extract. N% was estimated by using microKjeldahl method and protein was calculated.
The samples were tagged for anthesis, one week after the release of pollen and harvested 10, 17, 24 and 31 days after anthesis and at maturity. The period of seed development was thus divided in 4 stages after anthesis, 0-10, 11-17, 18-24 and 25-31 and 32 days.

The samples from developing seeds were taken from basal florets in the central region of each spike at every harvest. The harvested samples were stored in ice-cabs and processed immediately. N% was determined and protein was obtained by multiplying N x 5.75. The non-proteinaceous dry matter content was calculated by subtracting the quantity of protein per seed from seed weight. Since major part (95% of non-proteinaceous dm) in a seed is carbohydrate, it has been grossly taken as an index of carbohydrate accumulation (Frasar and Holmes 1959, Aylroyd and Doughty 1970).
**Field operations and inputs used in the experimental trials.**

**Table 1**

<table>
<thead>
<tr>
<th><strong>Field operations</strong></th>
<th><strong>Package of practices</strong></th>
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<tbody>
<tr>
<td>2. Seed bed</td>
<td>3. Two row, narrow bed</td>
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<tr>
<td>3. Basal dose of manure and chemical fertilizers kg/ha</td>
<td>4. Farm yard manure</td>
</tr>
<tr>
<td></td>
<td>10 t/ha single superphosphate 250 kg/ha</td>
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<tr>
<td></td>
<td>Ammonium sulphate, initial dose 10 kg/ha.</td>
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<tr>
<td>4. Top dressing tiller application.</td>
<td>Ferrous sulphate</td>
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<td></td>
<td>1.0 kg + 5 kg/500 lit. water/ha/spray.</td>
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<tr>
<td>5. Seed sowing</td>
<td>Spacing 30 x 10 cm</td>
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<tr>
<td></td>
<td>hand dibbling.</td>
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<tr>
<td>7. Herbicides</td>
<td>1. Velpar H&lt;sub&gt;1&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>2. Gesagard H&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>3. Sinbar H&lt;sub&gt;3&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>4. Simazine H&lt;sub&gt;4&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>5. Atrazine H&lt;sub&gt;5&lt;/sub&gt;</td>
</tr>
<tr>
<td>8. Concentrations: Sub-lethal</td>
<td>1. C&lt;sub&gt;1&lt;/sub&gt; control</td>
</tr>
<tr>
<td></td>
<td>2. C&lt;sub&gt;2&lt;/sub&gt; - .02 lb/ac.</td>
</tr>
<tr>
<td></td>
<td>3. C&lt;sub&gt;3&lt;/sub&gt; - .10 lb/ac.</td>
</tr>
<tr>
<td></td>
<td>4. C&lt;sub&gt;4&lt;/sub&gt; - .25 lb/ac</td>
</tr>
</tbody>
</table>
Grain hard (92)
Emergence of ear complete (59)
% of ear emerged (57)
Flag leaf ligule just visible (39)
Flag leaf just visible (37)
2nd node detectable (32)
1st node detectable (31)

Beginning of anthesis (61)
Anthesis half-way (65)
Anthesis complete (69)

Watery ripe (71)
Early milk (73)
Medium milk (75)
Late milk (77)
Early dough - finger nail impression not held (83)
Soft dough (85)
Hard dough - finger nail impression held, inflorescence losing chlorophyll (87)
9. Application of sub lethal doses:
Subsoil application at ages.

1. Early tillering
2. Maximum tillering
3. Flag leaf stage
4. Boot stage
5. Milk stage

Stage - I
Stage - II
Stage - III
Stage - IV
Stage - V.

10. Weeding. Uprooting
tall weeds

1) two times 20 DAS after
and 40 DAS.
2) light earthing up once
10 DAS.
3) uprooting tall weeds if
any, once 20 DAS.

11. Plant protection:

12. Irrigation
(including pre-sowing
irrigation)

As recommended by state
Seven irrigations in rabi
period including pre-sowing
irrigation

13. Sampling

Five random samples from
each replicate of every
treatment of herbicide and
each level of concentration
from the net plot area were
removed periodically at 5
stages of crop growth.

14. Harvesting

15. Drying, cleaning and
seed sample spreading

Manually

16. Plot size: Gross
Net

Manual

7.2 m x 6.0 m
5.6 m x 5.6 m
The control of weeds was planned after selecting the performance of the varieties and action of herbicides in the field condition.

The effect of cultivation practices on weed growth was considered a pre-requisite, while effect of herbicide levels pre- eminent.

The application of doses of sub-lethal concentration was done with a view to study the effect on growth and varietal responses to the treatments of herbicides.

The selection of herbicides was such that chemicals dealt effectively with weed flora and concentration levels were close to the tolerance level of genotypes. Hence, precise application with no mistakes of either over or under doses were given and then sub lethal concentration treatments were applied.

The wheat CV.H.D.- 2889 and CV.H.D.- 1555 were selected, since their performance reported superior to this area.

The variety CV.H.D.- 2888 is a dwarf and fast growing variety, the leaves are light green, erect broad. The flag leaf is prominent, leaves develop yellow flex. The ear heads are glabrous and glumes white. The seeds are bold, medium type. Average yield varying as 20-30/ha.

The variety HD - 1555 is a dwarf about 100 cm tall, it grows fast. Lvs are short, semi spreading, broad and light green; Peduncle is long and wavy ear heads glabrous, glumes brown. It is high tillering. The grains are medium sized, bold, they are in short spike, the variety is resistant to rust and loose smut.
Field Details:

The two varieties HD-2889 and HD-1555, certified samples from National Seed Corporation, New Delhi were received as gift material. The field trials were conducted at Science College in the year 1988-89, 1989-90.

The land was prepared with deep plough applying 20 cart loads of FYM subsequently, harrowed four times until soil attained fine tilth. Before cultivation, the field was leveled to avoid stagnation of water and to develop an even stand of crop. The cow dung manure dressing was done 20 days before seeding.

The experimental plots of 7.2 m x 6.0 m were initially treated with 10 kg N/ha (Ammonium sulphate) available 16% N by drilling method. The N application through Ammonium sulphate was a pretreatment of the schedule.

The soil samples of the experimental area were drawn in quadruplicates at different depths, (5, 10, 15 and 20 cm). On an average the pH ranged between 7.5 and 8.0.

Wheat seeds of the two Cv HD-2889 and W.H.D.-1555 were sown in the month of October 2nd week at a spacing of 30 cm between rows. This method of sowing in lines gave uniform germination and regular stand when sown at depth of 3 to 4 cms. The seed rate was 100 kg/ha, maintained around 200 plants per square meter. (2291 ADAS 1980 U.I.)

Herbicidal Treatment:

Five herbicides soluble in water at four different concentration (Table 1) were prepared separately and applied 10 days after the emergence of crop, the
sub-soil application was done in the drills between the rows with the help of mechanically operated pressure gun.

The control plots were treated with same amount of water to maintain identical experimental conditions. The four levels of concentration of five herbicides were applied at five different physiological stages of the crops.

Analysis:

The Analysis of samples collected in treatment of five herbicides of four levels of concentrations from two replicates were dried to constant weight at 98°C ± 2°C and then grounded to fine powder. The Nitrogen content of all the samples of each variety was determined by micro-Kjeldahl method with catalyst of H₂SO₄: CuSO₄ + 0.02. The total nitrogen and Non-protein nitrogen ratios were determined, crude protein was calculated (Byers, 1965) by N% = 5.75

Handling of wet sample:

The freshly harvested samples 30 cms, above ground level were crushed and pulped in power driven mixer having four pulley giving a driven speed of 3500 rpm. The pulp was collected and taken in muslin cloth and evenly pressed to get leaf (extract). pH of the extract was noted every time. 10 ml of extract was treated with equal volume of 10% trichloro acetic acid (TCA) and cooled at +4°C overnight before centrifuging.
The precipitate containing the TCA insoluble, protein nitrogen (PN) was suspended in 20 mls of distilled water. The supernatent containing soluble fraction of nitrogen known as non-protein nitrogen (NPN) was made up to final volume of 20 mls.

In each case 2 mls of protein fraction and non-protein fractions were taken for digestion. The total nitrogen, protein nitrogen in extract were estimated separately as PN, NPN, and TN. The protein and non protein nitrogen ratio were calculated at every physiological stage of the crop.

3.9. Calculation of results:

The method adopted was the same as described by Byers and Sturrock, (1965).

The biometric observations such as weed number, tiller numbers, spikelet/spike, grain number/spike, 1000 grains weight were subjected for statistical analysis. Similarly the data on chemical parameters too was processed and interpreted in the light of relevant methods suggested by Penae and Sukhatme.