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RESEARCH ARTICLE

# STABILITY ANALYSIS OF BREAD WHEAT VARIETIES FOR NITROGEN USE EFFICIENCY CONTRIBUTING TRAITS IN *TARAI* PLAINS OF UTTARAKHAND

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**Abstract:** The AMMI model was employed to assess the phenotypic stability of twelve bread wheat varieties over six environments under three nitrogen doses for two consecutive years i.e. 2012-13 and 2013-14 in Pantnagar. For spike length, UP 2825 was overall stable performer whereas, QLD 11 and GW 445 were found to adapt in $E_1$. For $E_3$ two genotypes i.e. DBW 97 and HD 3112 showed adaptability. In case of trait, number of spikelets per spike, no genotype was found stable but GW 445 in $E_2$ showed higher value for this trait and was found well adapted to this environment and QLD 33 also had higher value with adaptability to $E_3$.

**Keywords:** Stability Analysis, AMMI Model, Nitrogen Utilization Efficiency

## INTRODUCTION

Nitrogen (N) is one of the most important nutrient for cereals including wheat. Identification of N efficient wheat genotypes and their stability across environments by studying G × E interaction will help to reduce the economic burden upon farmers and also will decrease the environmental pollution due to excessive N application. Ortiz-Monasterio (1994) reported at low soil N levels there is better expression of uptake while at high N levels utilization is better expressed. It has also been reported that the efficiency components are inherited in a manner favourable for wheat selection (Gorny *et al.*, 2011). Various models for stability analysis have been employed in past but AMMI has proved to show better results for prediction of stability and adaptability of test varieties. By making use of basic interpretation of AMMI1 biplot graph which illustrates that if main effects have IPCA score close to zero, there is negligible interaction effects and when a genotype and an environment have the same sign on the IPCA axis, their interaction is positive; if different, their interaction is negative. The IPCA1 versus IPCA2 biplot (AMMI2 biplot), explain the magnitude of interaction of each genotype and environment. This method is more effective as it captures larger portion of G × E sum of square separating main and interaction effects. The goal of this study was to evaluate the G × E interaction using AMMI analysis for the traits contributing to nitrogen efficiency and singling out best stable genotypes across all the six environments as well as those adapted to specific ones.

## MATERIAL AND METHOD

The study involved twelve elite wheat genotypes *viz.*, DBW 97, DPW 621-50, GW 445, HD 3104, HD 3112, HD 2932, HD 2967, UP 2672, UP 2825, QLD 11, QLD 33 and QLD 39. The experiment was planned as per factorial experimental design (two years × three nitrogen doses × twelve genotypes) in which twelve treatments were randomized in three replications under three N (nitrogen) levels each for two consecutive years (*rabi*, 2012-13 and *rabi*, 2013-2014) at N. E. Borlaug Crop Research Center, Pantnagar. Nitrogen was applied at three rates, $N_0$: control (120kg/ha- recommended dose), $N_{100}$: N was applied @ 100kg/ha i.e. below recommended dose, and $N_{150}$: N was applied @ 150kg/ha i.e. above recommended dose. 1/3$^{rd}$ of N was applied at the time of sowing as basal dose, and 1/3$^{rd}$ each was applied at 1$^{st}$ and 2$^{nd}$ irrigation as top dressing. Therefore, we got six environments i.e. $E_1$ ($Y_1N_0$), $E_2$ ($Y_1N_{100}$), $E_3$ ($Y_1N_{150}$), $E_4$ ($Y_2N_0$), $E_5$ ($Y_2N_{100}$) and $E_6$ ($Y_2N_{150}$). Morphological traits related to nitrogen use efficiency were observed and data was collected accordingly.

## RESULT AND DISCUSSION

The pooled analysis of variance based on the AMMI model and per cent contribution of each component of source of variation to the total variation for all the characters have been depicted in Table 1 and Table 2, respectively. The mean sum of squares due to genotypes, environments and G × E interaction were highly significant for most of the characters. The G × E interaction was significant for various traits and it was further partitioned into three interaction PCA (IPCA) axes but only first two significant interactions (IPCA1 and IPCA2) were taken into account for the preparation of AMMI biplot graphs.

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**Table 1.** Pooled ANOVA using AMMI model for different characters across the environments

| Source of variation | Df | SL | SN |
|---|---|---|---|
| **REP(ENV)** | 12 | 0.12 | 2.0207 |
| **ENV** | 5 | 9.92*** | 12.03** |
| **GEN** | 11 | 5.12*** | 11.74*** |
| **ENV:GEN** | 55 | 0.44 | 3.56*** |
| **IPCA1** | 15 | 0.83 | 4.92*** |
| **IPCA2** | 13 | 0.51 | 5.08*** |
| **IPCA3** | 11 | 0.29 | 2.90 |
| **IPCA4** | 9 | 0.15 | 1.88 |
| **Residuals** | 7 | 0.08 | 0.99 |
| **Pooled Error** | 132 | 0.34 | 1.65 |

*****, **, *** = .1%, 1% and 5% respectively; ENV- Environment; REP- Replication; GEN- Genotype; PC1- Principal component 1; PC2- Principal component 2; PC3- Principal component 3, SL: spike length, SN: number of spikelets/spike.

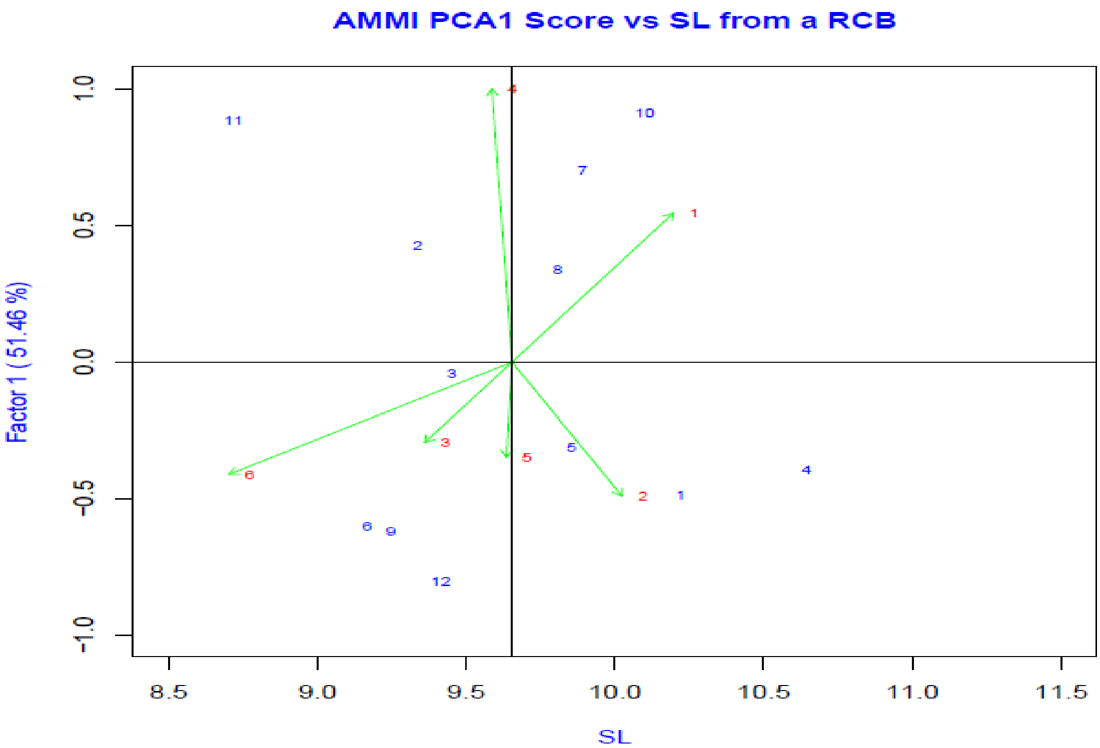
**Table 2.** Percent Contribution of different source of variation to the total variation

| | SL | SN |
|---|---|---|
| **ENV** | 28.07 | 9.59 |
| **GEN** | 31.88 | 20.59 |
| **ENV:GEN** | 13.74 | 31.19 |
| **IPCA1** | 51.46 | 37.71 |
| **IPCA2** | 27.34 | 33.76 |
| **IPCA1+ IPCA2** | 78.80 | 71.47 |

ENV- Environment; REP- Replication; GEN- Genotype; PC1- Principal component 1; PC2- Principal component 2; PC3- Principal component 3, SL: spike length, SN: number of spikelets/spike

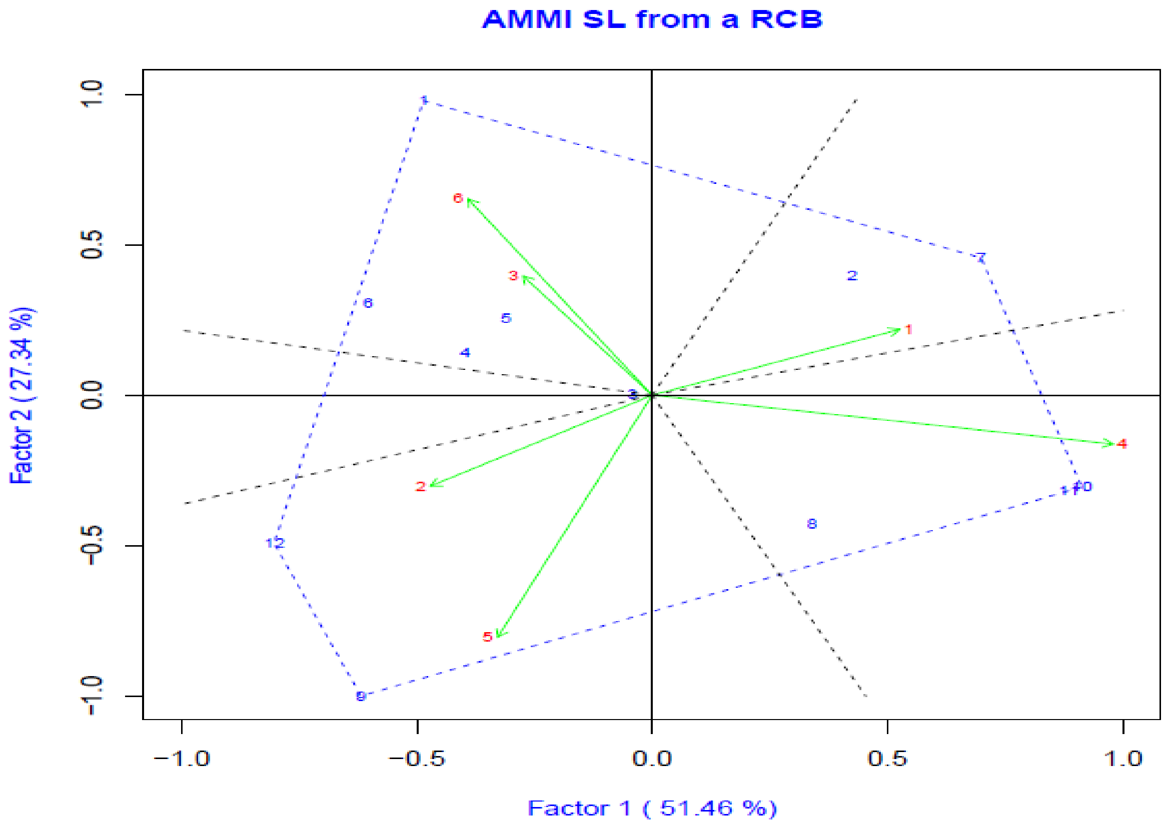
The pooled analysis of variance in AMMI model for spike length showed that environmental contribution to total variation was 28.07% while genotypic and G × E interaction effects shared 31.88% and 13.74% variation to the variation, respectively. The IPCA1 and IPCA2 of G × E interaction captured 51.46% and 27.34% of total interaction variation, respectively, and cumulative effect was 78.80% of the total interaction variation. The six genotypes on the right hand side of vertical line were having more spike length in which HD 3112 (10.65), QLD 33 (10.22) and UP 2672 (10.1) showed maximum spike length. In contrast, six genotypes were on left hand side of vertical line in which HD 2967, QLD 11, QLD 39 and HD 2932 had least value for this trait. Especially, HD 2967 (8.72) and QLD 39 (9.17) had the least value from the mean for spike length. Among the test environments, $E_1$ and $E_2$ occupied position on the right hand side of the midpoint of the main effect axis and seemed to be favorable environments in which $E_1$ displayed most favorable one. Regarding genotypes, UP 2825 was found most stable across all environments for spike length as it had no interaction or least affected by environmental factors. For number of spikelets per spike, pooled analysis of variance indicated that 9.59% of the total variation was due to environmental effects, 20.59% to genotypic effects and 31.19% to G × E interactions effects.

The IPCA1 of the G × E interactions effect captured 37.71% of the interaction variation while, 33.76% of the G × E interactions variation was due to IPCA2 component, cumulatively contributed to 71.47% of total interaction variation.



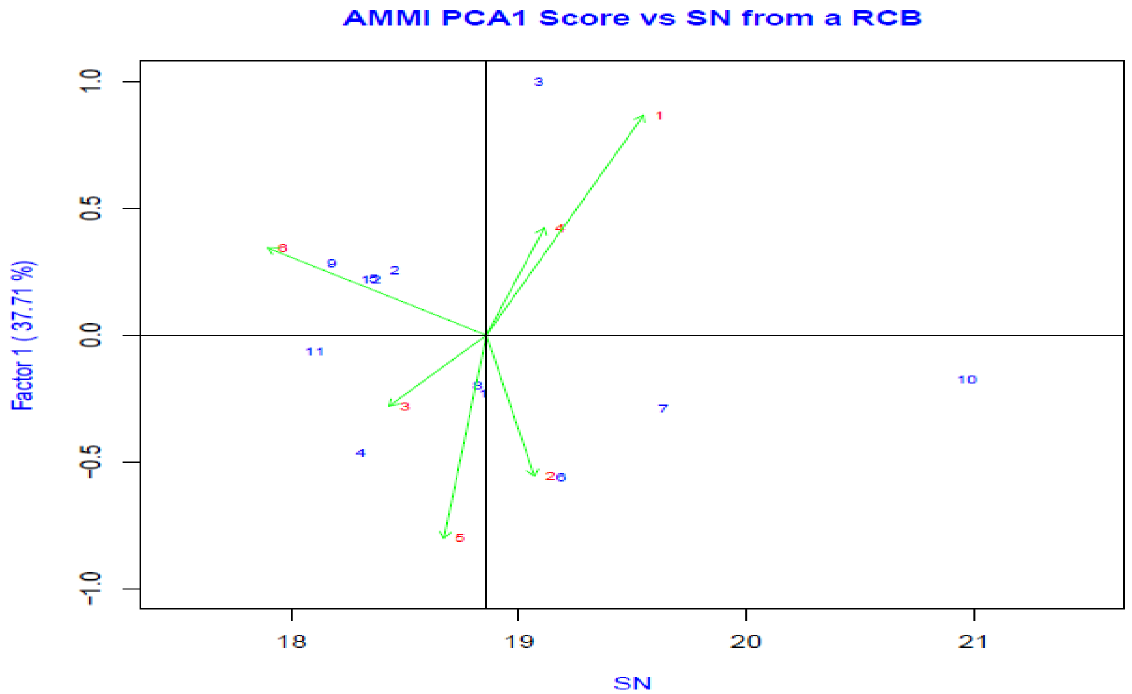

AMMI1 biplot for spike length across the environments

1 – 10: UP 2672, QLD 11, UP 2825, HD 3112, DBW 97, QLD 39, GW 445, HD 3104, HD 2932, QLD 33, HD 2967, DPW 621-50 respect; 1, 2,3,4,5,6: $E_1$, $E_2$, $E_3$, $E_4$, $E_5$, $E_6$ environments respect.



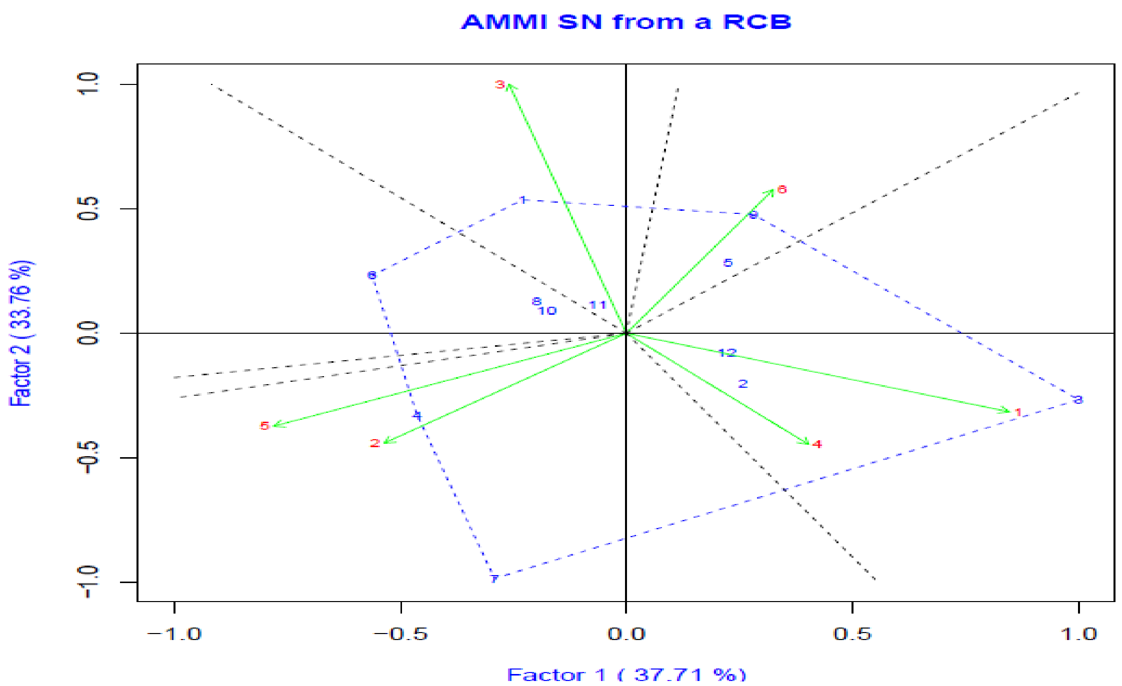

AMMI2 biplot for spike length across the environments

1 – 10: UP 2672, QLD 11, UP 2825, HD 3112, DBW 97, QLD 39, GW 445, HD 3104, HD 2932, QLD 33, HD 2967, DPW 621-50 respect; 1, 2,3,4,5,6: $E_1$, $E_2$, $E_3$, $E_4$, $E_5$, $E_6$ environments respect.




AMMI1 biplot for number of spikelets across the environments
1 – 10: UP 2672, QLD 11, UP 2825, HD 3112, DBW 97, QLD 39, GW 445, HD 3104, HD 2932, QLD 33, HD 2967, DPW 621-50 respect; 1, 2,3,4,5,6: $E_1$, $E_2$, $E_3$, $E_4$, $E_5$, $E_6$ environments respect.

In case of AMMI1 biplot analysis, relative variability due to genotypes was in lower magnitude than environmental effect variability as seen on AMMI1 biplot display. HD 2967 had lowest spikelet number (18.10) and with less IPCA1 score indicating more stability across the environments. The value for spikelet number in UP 2672 was closest to the mean but was having IPCA1 score quiet good therefore it was less stable across environments.




AMMI2 biplot for number of spikelets across the environments
1 – 10: UP 2672, QLD 11, UP 2825, HD 3112, DBW 97, QLD 39, GW 445, HD 3104, HD 2932, QLD 33, HD 2967, DPW 621-50 respect; 1, 2,3,4,5,6: $E_1$, $E_2$, $E_3$, $E_4$, $E_5$, $E_6$ environments respect.

In contrast, four genotypes were on right hand side of vertical line showing larger spikelet number with QLD 33 showing more value for this trait and stability across all environments. QLD 39 showed value for this trait as 19.19 but shows suitability for a particular environment. Among the test environments, $E_5$, $E_6$ and $E_3$ occupied left position to the vertical line and seemed unfavorable for consideration for this trait. $E_4$ being the most favorable environment as it gave stable genotype (Motamedi *et al*., 2013).

$E_1$ and $E_4$ had large scores on IPCA1 and lower IPCA2 score while $E_2$ showed almost similar scores of IPCA1 and IPCA2. $E_6$, $E_5$ and $E_3$ had large score on IPCA2 and lower score on IPCA1. In AMMI2 biplot, display positions of genotypes on the environmental vector showed that DBW 97 was well suited to $E_6$ whereas, HD 2967 was found well adapted to $E_3$ as it had very less IPCA1 and IPCA2 scores ( Purchase and Hatting, 2000). DPW 621-50 was found adaptable to $E_1$ but had lesser score for IPCA2 but more IPCA1. QLD 33 was adapted to environment $E_3$ because of close acute angles between environment and genotypes but had lesser score for IPCA2 and more for IPCA1. HD 2932 was most desirable due to its higher spikelet number than other genotype adapted to $E_6$. In $E_1$, DPW 621-50 was found to show good response in having more value for spikelet number and classified as desirable with less interaction. Significant environmental main effect was seen for this trait. The G × E interaction effect was significantly high for number of spikes. For spike length, overall stable performer was UP 2825 whereas, QLD 11 and GW 445 were found to adapt in $E_1$. For $E_3$ two genotypes i.e. DBW 97 and HD 3112 (showed higher value for this trait) showed adaptability. For environment $E_4$, HD 2967 and QLD 33 and for $E_6$, DBW 97 and UP 2672 showed adaptability. In case of trait, number of spikelets per spike, no genotype was found stable enough but GW 445 in $E_2$ showed higher value for this trait and is well adapted to this environment similarly; QLD 33 also had higher value with adaptability to $E_3$. So, these genotypes could be considered best for such environment (Rad *et al.*, 2013 and Saleem *et al.*, 2015).

## CONCLUSION

$E_6$ (environment under higher than recommended dose of nitrogen i.e. $N_{150}$ for year, $Y_2$) showed least effect of GEI thus was quiet stable environment for the study. $E_1$ and $E_4$ (recommended dose applied during year $Y_{1,}$ $Y_{2,}$ respectively) showed highest GEI thus proved to be most diverse environments giving significant variability. UP 2825 was one of the best genotypes showing positive correlation of traits contributing nitrogen use efficiency. It was found to have stability for various characters such as spike length.

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RESEARCH ARTICLE

# GROWTH RESPONSE OF *HELIANTHUS ANNUUS* CV. SINGLE MINIATURE TO SULPHUR DIOXIDE POLLUTION

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**Abstract:** Sulphur dioxide ($SO_2$) is one of the principal contributor to air pollution. In the gaseous form it is called as primary pollutant but when it binds moisture from the air and forms aerosols of sulphuric- and sulphurous acid which are deposited as acid rain, it acts as secondary pollutant. Plants after exposure to $SO_2$ show altered growth patterns. The ornamental cultivar cv. Single Miniature of *Helianthus annuus* L.(family Asteraceae) on fumigation with four cumulative doses 2612, 3265, 3918 and 4571µg m$^{-3}$ of $SO_2$ manifested a decline in the length, fresh weight and dry weight of shoot, root and whole plant respectively. These growth attributes were studied at 30$^{th}$, 50$^{th}$,70$^{th}$ and 90$^{th}$ day of the fumigated cultivar along with a control set. The concentration of pollutant and duration of exposure measure the severity of injury in the fumigated plants. The present investigation reveal that sulphur dioxide acts as a kind of stress to plants.

**Keywords:** Aerosols, Growth, *Helianthus*, Pollutant, $SO_2$

## INTRODUCTION

Among the various air pollutants, sulphur dioxide ($SO_2$) is one of the principal contaminants. Sulphur dioxide cause severe damage to vegetation under natural and control conditions (Verma and Agarwal,1996).Acute and chronic exposure to $SO_2$ can result in the general disruption of photosynthesis, respiration, as well as, other metabolic and fundamental cellular processes (Ewald and Schlee,1983).Sensitivity of $SO_2$ varies within and amongst plant species (Yusuf et al.,1985) and also depends upon the plant age, its development and various ecological conditions like solar radiation, temperature, humidity and edaphic factors (Heck and Dunning,1978).In the present study, long term effects of different concentrations of $SO_2$ were studied on various growth parameters of the ornamental cultivar ,cv.Single Miniature of *Helianthus annuus* L.(family Asteraceae).

## MATERIAL AND METHOD

Seeds of *Helianthus annuus* cv. Single Miniature were procured from IARI, New Delhi. The seeds were sown in polythene bags filled with sandy loam soil. The plants were treated with 2612, 3265, 3918 and 4571 µg m-3 $SO_2$ for 2h daily from 11$^{th}$ day to maturity of the crop using 1m$^3$ polythene chambers in which circulation of air was maintained by a small fan to facilitate thorough mixing of air inside the chambers. The $SO_2$ gas was prepared chemically by reacting sodium sulphite with concentrated sulphuric acid. A control set was also run in identical conditions but without exposure to $SO_2$.The plant samples were studied at 30$^{th}$, 50$^{th}$, 70$^{th}$ and 90$^{th}$ day for various growth parameters (length of shoot, root and whole plant, fresh weight of shoot, root and whole plant, dry weight of shoot, root and whole plant).The individual plants were dug out from the soil carefully having the root and shoot system intact. The plants were washed thoroughly with tap water to detach soil mass adhering to the roots followed by air drying on blotting papers. The length of shoot and root was measured separately and their total was considered as whole plant height. Later, shoot and root was weighed separately for their fresh weight. For dry weight estimation, plant parts were dried in an oven at 80$^o$C for 24h and weighed. Fresh- and dry weight of the whole plant was estimated by mere addition of fresh- and dry weight of shoot and root respectively.

## RESULT

Findings regarding the effect of pollutant revealed that $SO_2$ affected the studied cultivar adversely. It was noted that higher was the concentration of the pollutant, more prominent were the effects (Table - 1). A pronounced reduction in shoot, root and total plant height was observed. However, the root length was found to be decreased more than the shoot length. Plant height in 90d old plants at 4571 µg m$^{-3}$ of $SO_2$ showed 60% reduction. Fresh weight of shoot, root and whole plant showed appreciable decrease with roots showing more losses in comparison to shoot and the reductions were significant at 1% level from the age of 30d onwards at concentration 4571 µg m$^{-3}$ of $SO_2$. Dry matter accumulation revealed that dry weights of shoot, root and whole plant showed more appreciable reductions as compared to their fresh weights. However, decrease in dry weight of root was more than that of shoot.79.37% decrease was recorded in root dry weight at 50d old plants at 4571 µg m$^{-3}$ of $SO_2$.

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## DISCUSSION

The present investigation revealed that sulphur dioxide act as a kind of stress to plants and its fumigation caused considerable reduction in different growth attributes. A response in shoot length is a convenient, and relatively sensitive parameter of plant growth. However reduction in root length was more than in shoot, which can be explained by the fact that roots come in contact with the pollutant earlier than shoot (Wali,2000). Phytomass is an additional and better measure of growth in comparison to height because it incorporates all the tissues whereas height measures only the tallest part of the plant. In the present case, reduction was higher in roots in comparison to shoots. Reduction in root biomass of the plant is due to slow translocation of metabolites in the roots as photosynthetic activity is depressed by the pollutant (Saxe,1983). Kasana and Mansfield (1986) opined that more assimilates are retained in the shoots and less transported to the roots, so that there are more reductions in the biomass of the roots than shoot. It is quite clear from the observations that the magnitude of damage caused by 2612,3265 μg $m^{-3}$ of $SO_2$ were lesser in comparison to 3918 and 4571 μg $m^{-3}$ $SO_2$. Moreover, the pollutant produced more appreciable effects on 90d old plants than 70, 50 and 30d old plants. Such effects of $SO_2$ with increasing age of the plants have also been reported by Bell (1982) in grasses and Prasad and Rao(1982) in legumes and cereals.

**Table 1.** Growth response of *Helianthus annuus* L.cv. Single Miniature on exposure to different concentrations of $SO_2$.

| Plant age,d | $SO_2$ (μg $m^{-3}$) | Attribute | | | | | |
|---|---|---|---|---|---|---|---|
| | | Shoot length (cm) | Root length (cm) | Shoot fresh wt(g) | Root fresh wt(g) | Shoot dry wt(g) | Root dry wt(g) |
| 30 | 0 | 28.20 | 15.16 | 8.407 | 2.374 | 2.219 | 0.834 |
| | 2612 | 24.02 | 13.84 | 7.567 | 2.111 | 2.052 | 0.733 |
| | 3265 | 22.04* | 10.82** | 6.732** | 1.639 | 1.813 | 0.534 |
| | 3918 | 20.94* | 9.040** | 5.895** | 1.404** | 1.566** | 0.381 |
| | 4571 | 18.94** | 7.720** | 4.922** | 1.183** | 1.278** | 0.218** |
| | CD5% | 6.162 | 3.323 | 1.107 | 0.755 | 0.524 | 0.526 |
| | CD1% | 8.639 | 3.592 | 1.197 | 0.817 | 0.566 | 0.569 |
| 50 | 0 | 51.88 | 22.24 | 21.14 | 8.679 | 11.73 | 5.106 |
| | 2612 | 43.56 | 15.78** | 15.86** | 5.548** | 8.391** | 3.138** |
| | 3265 | 38.40** | 12.94** | 12.25** | 4.513** | 6.424** | 2.307** |
| | 3918 | 37.80** | 10.98** | 11.35** | 3.976** | 5.837** | 1.862** |
| | 4571 | 33.94** | 8.300** | 8.962** | 3.136** | 4.146** | 1.053** |
| | CD5% | 9.243 | 2.172 | 1.657 | 1.250 | 0.938 | 0.871 |
| | CD1% | 12.95 | 2.348 | 1.791 | 1.351 | 1.014 | 0.942 |
| 70 | 0 | 78.50 | 30.08 | 35.94 | 18.84 | 19.79 | 11.35 |
| | 2612 | 63.88** | 20.56** | 27.65** | 12.56** | 15.88 | 7.757* |
| | 3265 | 48.38** | 16.40** | 20.93** | 9.537** | 10.92** | 5.033** |
| | 3918 | 42.92** | 11.72** | 16.91** | 7.316** | 8.033** | 3.398** |
| | 4571 | 38.36** | 9.460** | 14.44** | 6.452** | 6.745** | 2.614** |
| | CD5% | 2.498 | 1.615 | 5.951 | 5.671 | 5.716 | 3.484 |
| | CD1% | 2.700 | 1.745 | 6.432 | 6.130 | 6.178 | 3.766 |
| 90 | 0 | 94.52 | 43.86 | 48.00 | 28.21 | 30.33 | 18.31 |
| | 2612 | 76.54** | 29.28** | 33.80** | 17.80** | 21.71** | 11.48** |
| | 3265 | 57.04** | 21.68** | 24.98** | 12.74** | 14.83** | 7.220* |
| | 3918 | 50.90** | 16.66** | 20.67** | 9.531** | 11.05** | 4.956** |
| | 4571 | 42.05** | 12.56** | 18.12** | 7.541** | 9.638** | 3.824** |
| | CD5% | 1.954 | 2.009 | 12.79 | 6.933 | 6.337 | 5.699 |
| | CD1% | 2.112 | 2.172 | 13.83 | 7.494 | 6.850 | 6.160 |

CD – Critical difference
*Significant at 5% level.
**Significant at 1% level.

## CONCLUSION

It is delineated from the above analyses that all the four concentrations of $SO_2$ used in the experiment affected the studied cultivar adversely causing appreciable reductions in growth attributes.

## ACKNOWLEDGEMENT

I am grateful to Prof. G.Prakash, my guide, Rtd. Head, Dept. of Botany, C. C. S. University, Meerut, for his guidance and support.

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RESEARCH ARTICLE

# INFLUENCE OF INDOL-3-BUTYRIC ACID (IBA) AND VARIOUS TIME ON ROOTING OF GUAVA (*PSIDIUM GUAJAVA* L.) AIR LAYERING

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**Abstract:** An experiment was carried out during 2014-15 at Horticulture research center, Department of Horticulture, Chauras Campus, HNB Garhwal Central University, Srinagar (Garhwal), Uttarakhand India. Four different concentrations of IBA viz., 2000ppm, 3000ppm, 4000ppm, 5000ppm were used in four time of layering (May, June, July and August). Amongst various concentrations of IBA, 5000ppm concentrations of IBA treatment proved best treatment in respect of percent rooted, number of primary roots, root quality. In case of time of layering August month the maximum rooting success.

**Keywords:** Guava, IBA, Time, Rooting percentage, Survival percentage

## INTRODUCTION

Guava (*Psidium guajava* L.) is one of the most important fruit crop in India. It is belong to Myrtaceae family and place of origin of guava is tropical America. It is a rich source of Vitamin-C (260mg/100gm) which is the second after aonla (600mg/100gm). Guava can be used in preparation of Juice, Jam and Marmalade (Hossen *et al.*, 2009). India is the major producer of Guava in the world. It is cultivated in almost all parts of the country. The total fruits area and production has been estimated at 7216 thousand ha, 88977 thousand MT annually (NHB, 2013-14).
Bose *et al*. (1986) showed that the time of layering and detachment of layers from the mother plants is the most important factor for rooting success because of presence of sufficient soil moisture, humidity and optimum temperature which are prerequisites of highest survival of the detached air- layers. So, propagation is also recommended in proper time for maximum survival of the detached air- layers in case of guava. Chinees layering are also known as air layering, pot layering, and gooty. Air layering is also practiced in jackfruit (Mukharjee and Chatterjee, 1978), guava (Sarker and Ghose, 2006) and citrus (Kumar and Gill, 1996). Bari (2002) observed that the maximum rooting percentage, survival percentage was showed under mid June layers prepared time. The use of plant growth regulators to increase the efficacy of propagation in cutting and layering are now common and moreover, use of growth regulators has opened a new vista for nurserymen for propagation of fruit trees. The success of air- layers depends on the use of optimum concentration of IBA and time of application (Sharma *et al*. 1975). Root inducing auxins enhanced the success of air layering by producing roots easily (Patel *et al*. 1996). Sharma *et al*. (1991) recorded that the maximum rooting and survival percentage was observed under 10000ppm concentration of IBA with July month.

## MATERIAL AND METHOD

The present investigation was conducted in month of August 2014 in the mist house located at the Horticultural Research Centre, HNB Garhwal University, Srinagar Garhwal, Uttarakhand, India. The research centre is situated in the Alaknanda valley at $30^0$ 13’ 25.26’’ N and $78^0$ 48’ 04.93’’ E and 563 m above mean sea level, and exhibits a subtropical climate with dry summer and rigorous winters with occasional dense fog in the morning hours from mid December to mid February.
Five year old matured, healthy and vigorous plants were selected for the experimental work. On the selected plants the shoots of uniform age (one year old) and of pencil thickness were randomly selected for air layering. Material used during experimentation moss grass for rooting media, IBA five treatment (2000ppm, 3000ppm, 4000ppm, 5000ppm and 0ppm) and four time of operation (May, June, July and August) with black polythene sheets (200 μ gauge) for wrapping. The experiment was laid out in Randomized Block Design (RBD) with five concentrations of IBA, four time of operation (May, June, July and August) and three replications. The data pertaining to root and shoot character were tabulated and statistically analysed as per the methods outlined by Cochran and Cox (1992).

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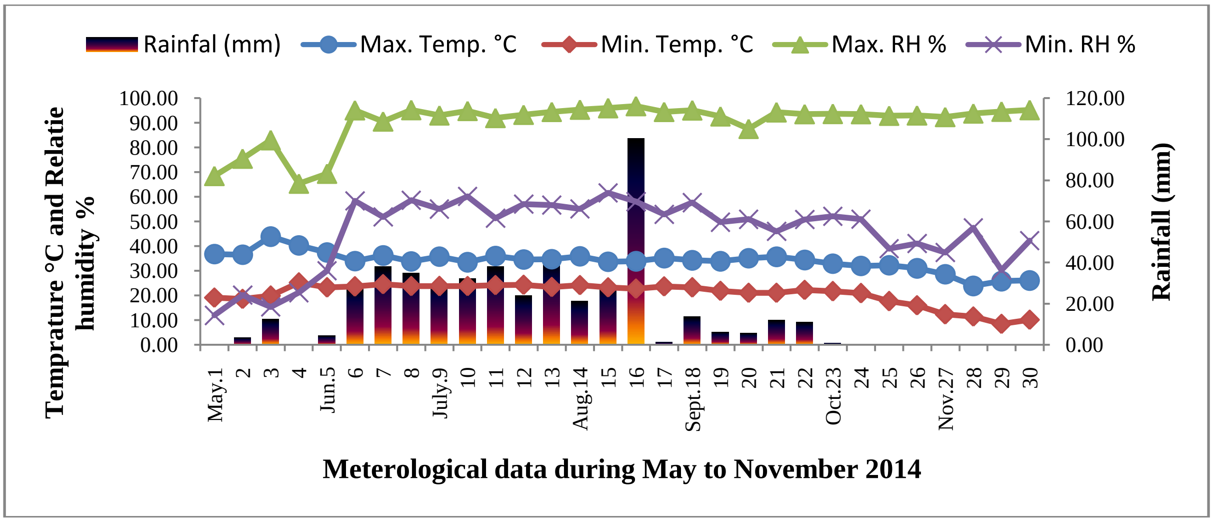


**Fig. 1.** Metrological observation during the experimental period at weekly interval 2014

## RESULT AND DISCUSSION

The perusal of data (Table 1) revealed that all plant growth regulators significantly influenced rooting an survival percentage in layered plant. The highest rooting percentage (84.667%) was recorded under 5000ppm concentration of IBA followed by 3000ppm IBA while the minimum rooting percentage (38.333%) was observed in under control treatment. This might be due to the fact that optimum concentration of IBA may have caused mobilization and utilization of carbohydrates and nitrogen fraction with the presence of co-factors at wound site which may have helped in better root initiation. Hence, IBA at highest concentration resulted in good rooting of the guava air layers. Further the superiority of IBA in producing higher percentage of rooting compared to NAA might be due to their respective differences in initializing hydrolysis of nutritional reserves. Plant layer treated with IBA 5000ppm produced maximum survival percentage (81.667%) while the lowest survival percentage was observed under control. Significantly maximum number of primary root (8.607) was recorded with IBA 5000ppm and the minimum number of primary root observed under (4.147) control treatment. The similar results have been reported by Sharfuddin and Hussian (1973) in litchi and Chawla *et al.* (2012) in litchi. Growth substances accelerate the rooting, produce a large root system and increase the percentage of survival. Growth regulators like IAA, NAA and IBA have been used to stimulate plant growth and specially root formation in layering. IBA has been found to be most effective in producing maximum number of roots with better vigour.

The maximum number of shoot and leaf/layer (8.110 and 8.110) was recorded under 5000ppm concentration of IBA while minimum were observed in control. The application of root promoting substances during layering to get best rooting within a minimum time period and IBA has been found most effective (Nanda and Kochhar, 1985). The maximum length of longest root/layer (7.663cm) was showed under 4000ppm IBA and the minimum length of longest root/layer was reported under control treatment. This result is in conformity with the findings of Rymbai and Reddy (2010) in guava. Several workers have reported successful results by the use of plant growth regulators in stimulating of root primordia in air layering of guava crop (Bhagat *et al.*, 1999; Singh and Bhuj, 2000; Tyagi and Patel, 2004 and Singh *et al.*, 2007). Auxin particularly IBA, NAA and IAA have reported to induce rooting in many of the species with varied success. However, the response to treatment with different growth substances varies with species to species and with changing physiological and environmental factors.

In case of time of layering significantly the maximum percentage of rooted and survival layer (83.333% and 80.667%) was observed under August time while the minimum was recorded under June layering time. Season was the important factor for successful layering in woody plant because of rooting on layers enhance by light and presence of sufficient moisture and optimum temperature. The similar results were reported by Dhillon and Mahajan (2000) in litchi.

The maximum number of primary root/layer (7.617) was observed under July time while the minimum number of primary root/layer (5.543) was recorded under May time of operation. July and August is best for root development of air layers in guava at Garhwal Himalayan region. These results are in conformity with Sarker and Ghose (2006) in guava. Significantly the maximum length of longest root (6.853 cm) was showed under August time of operation and the minimum length of longest root (3.640cm) was observed under July month. Present findings are in conformity with the results of Shukla and Bajpai (1974) in litchi. Highest number of shoot and root/layer (7.293 and 8.330) were observed under August time of operation and minimum was recorded under July month (Table 2 and Fig 2). Akhter (2002) observed that the vegetative propagation of guava by layering is done during summer of the year i.e. from February to August with varying success and survival. It is found that certain percentage of layers die in the nursery due to untimed layering, detachment shock of layers and other factors particularly low atmospheric humidity, soil moisture, low night temperature and scorching sun light of the day etc. These results further get support from the findings of Sharma and Grewal (1989) in litchi and Kanwar and Khalon (1986) in litchi.

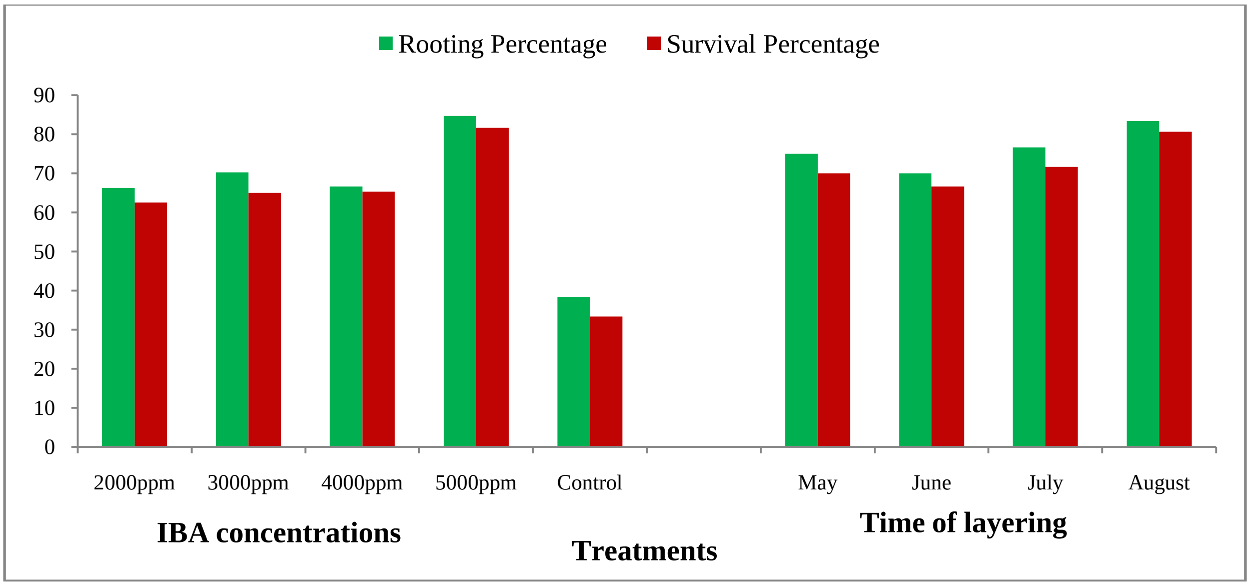


**Fig. 2.** Effect of IBA concentrations and times on rooting and survival percentage of air layering

**Table 1.** Effect of IBA concentrations on root and shoot character of air layers of Guava

| IBA concentration | Rooted Percentage | Survival Percentage | Number of primary root | Length of longest root (cm) | Number of shoots/layer | Number of leaf/layer |
|---|---|---|---|---|---|---|
| **2000ppm** | 66.220 | 62.517 | 5.000 | 6.110 | 5.183 | 7.667 |
| **3000ppm** | 70.220 | 65.000 | 5.553 | 6.553 | 5.887 | 6.220 |
| **4000ppm** | 66.663 | 65.333 | 7.777 | 7.663 | 7.113 | 6.887 |
| **5000ppm** | 84.667 | 81.667 | 8.607 | 7.327 | 8.110 | 7.777 |
| **Control** | 38.333 | 33.333 | 4.147 | 3.073 | 3.667 | 4.220 |
| **S.Em** | 0.931 | 3.165 | 0.294 | 0.244 | 0.269 | 0.339 |
| **CD at 5%** | 3.036 | 10.318 | 0.960 | 0.796 | 0.877 | 1.106 |
| **CV** | 2.474 | 8.906 | 8.207 | 6.890 | 7.784 | 8.971 |

**Table 2.** Effect of Time on root and shoot character of air layers of Guava

| Planting Time | Rooted Percentage | Survival Percentage | Number of primary root | Length of longest root (cm) | Number of shoots/layer | Number of leaf/layer |
|---|---|---|---|---|---|---|
| **May** | 75.000 | 70.000 | 5.543 | 5.073 | 5.663 | 7.443 |
| **June** | 70.000 | 66.667 | 6.110 | 6.297 | 6.473 | 8.073 |
| **July** | 76.667 | 71.667 | 7.617 | 3.640 | 5.330 | 7.333 |
| **August** | 83.333 | 80.667 | 5.997 | 6.853 | 7.293 | 8.330 |
| **S.Em** | 1.984 | 2.000 | 0.177 | 0.174 | 0.108 | 0.547 |
| **CD at 5%** | 6.855 | 6.912 | 0.612 | 0.600 | 0.374 | 1.892 |
| **CV** | 4.506 | 4.795 | 4.857 | 5.499 | 3.026 | 12.163 |

## CONCLUSION

Among IBA, 5000ppm concentration of IBA found the most effective for rooting percentage, growth attributes and survival percentage in air-layering of guava. The month of August showed significant effect on better rooting and survival performance on guava.

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RESEARCH ARTICLE

# OPTIMISATION OF *THALASSIOSIRAWEISSFLOGII* CULTURE REGIMES WITH REFERENCE TO NITROGEN INPUTS

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**Abstract:** This work deals with the response of *Thalassiosira* to the influence of low nitrate and high availability and understanding the results from a quantitative viewpoint. Cell stress responses to nitrogen limitation were observed. The culture kept at lower temp absorb more nutrients and the cell size appeared large than the regular cells. High nitrogen induction was inhibitory in growth performance that 100 and 200 ppm N showed fairly better cell growth responses.

**Keywords:** Nitrogen, Cell, Phosphorus, Macronutrients

## INTRODUCTION

Live feed continues to be the principal nutritional basis for culture of larvae (Richmond, 2004). Shrimp prefer diatoms than other microalgae (Ju, Forster &Dominy 2009).*Thalassiosira* got into the limelight with the Vannamei farming bloom in India. For Indian conditions and seawaters, the metal profile and bacterial complexes determine the size, shape and biochemical content of the strain in particular. The culture of Vannamei introduced in Indian waters needs elaborate studies for standardisation and refinement of nutrient amounts and applications. The objective of this study is to culture Thalassiosira and observe the cell count with varying nitrogen concentrations.

## MATERIAL AND METHOD

The *Thalassiosira*culture was cultured with three different nitrogen concentrations – 300 ppm, 200 ppm and 100 ppm but the rest of the nutrients remaining the same as f2 media. The experiments were conducted with 10 ml test tubes. Culture conditions were 18 degrees temperature and 30-32 ppt salinity.

## RESULT

Nitrogen variability effects on *Thalassiosira*cell numbers and dry cell weight

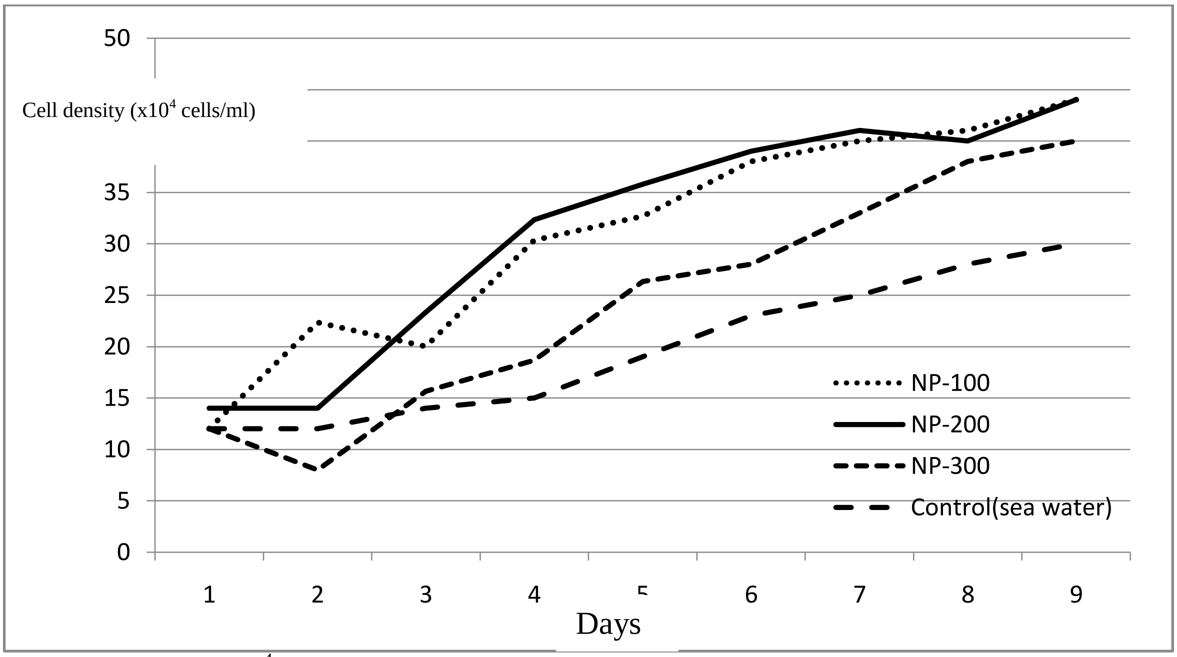


**Fig. 1.** Cell density (x$10^4$ cells/ml)of *Thalassiosira* in response to varying nitrogen concentrations with time (days)

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**Fig.1.** Shows that Nitrogen concentration at 100 ppm and 200 ppm reached the same cell density within the same residence time. 300 ppm was inhibitory on Thalassiosira. However, a progressive rise was visible for 100 ppm rather than 200 ppm levels.

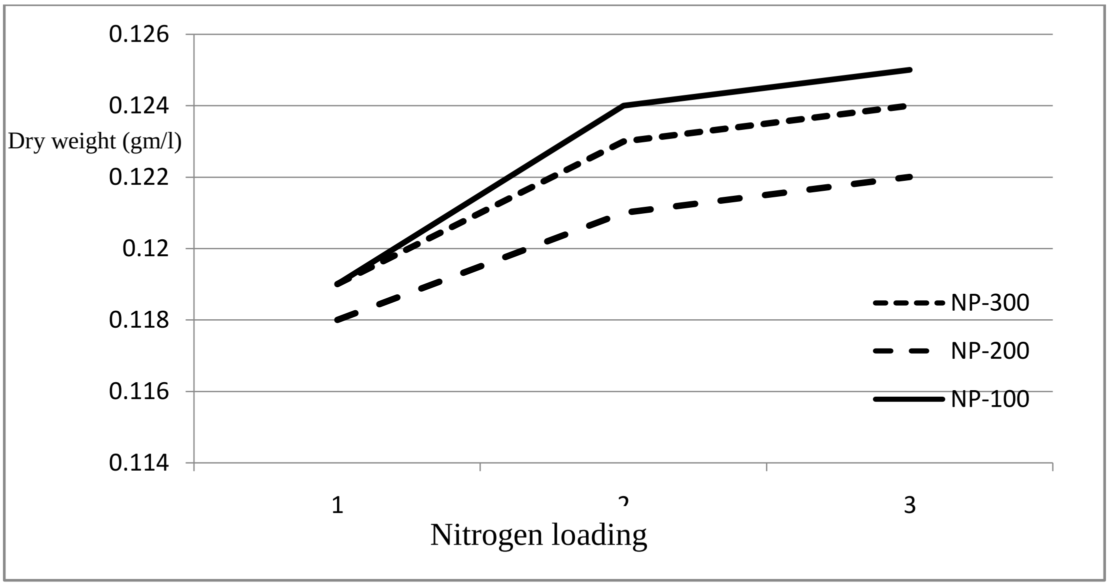


**Fig. 2.** Dry weight (gms per litre) of *Thalassiosira* in response to Nitrogen loading

Regarding the dry weight of Thalassiosira cell, 100 ppm nitrogen concentration registered better cellular protoplast and biomass than rest of the treatments as seen in Fig. 2.

## DISCUSSION

Macronutrients such as nitrogen and phosphorus are believed to limit phytoplankton production in many marine and freshwater communities; consequently the uptake kinetics of these nutrients have long been of interest to physiologists and ecologists (McCarthy, 1981:Cembella*et al*., 1984).

Diatom blooms commonly occur in regions where nitrogen (N) source is variable and they possess a suite of N-related transporters and enzymes (Allen 2005; Armbrust*et al*., 2004; Hildebrand, 2005; Hildebrand and Dahlin, 2000) and utilize a variety of inorganic (e.g., nitrate, NO3-; ammonium, NH4+) and organic (e.g., urea; amino acids) N sources for growth. Diatoms exhibit their fastest growth rates on reduced forms of N such as NH4+ or urea (Dortch, 1990; Dortch *et al*., 1991; Peers *et al*., 2000; Syrett 1981), in part due to the low energetic costs associated with assimilation of these forms (Hildebrand, 2005).

When cells experience high daily irradiance, N is partitioned between the plastid during the day and the mitochondria at night with variations based on a particular N source (Bender *et al*., 2012). The impact of N source on differential transcript accumulation was most apparent under the highest light intensity in *Thalassiosirapseudonana* (Bender *et al*., 2012). The present study clearly indicates insufficient studies on nitrogen effects on Thalassiosira from the dearth of related literature. Silicate approves to be a key factor for growth acceleration and cell multiplication.

Conclusions drawn from the study are – 100 ppm nitrogen concentration are sufficient for Thalassiosira growth and multiplication and dry matter per cell accrual under controlled conditions.

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RESEARCH ARTICLE

# INFLUENCE OF CROP MANAGEMENT PRACTICES ON YIELD, YIELD ATTRIBUTES AND ECONOMICS OF HIGH ZINC RICE

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**Abstract:** An experiment to evaluate influence of crop management practices on yield and economics of high zinc ricewas conducted at Research cum Instructional farm, I.G.K.V., Raipur, during *kharif*season of 2013. The experiment was laid out in factorial randomized block design with four replications. Treatment comprised of three spacing *viz.,*10cm x 10cm, 15cm x 10cm and 20cm x 10cm and three levels of nutrient *viz.,* 50%, 100% and 150% RDF. The result revealed thatspacing of 20cm x 10cm recorded higher panicle length, panicle weight, number of total grains/panicle, number of filled grains/panicle, test weight, grain yield, harvest index,gross return, net return and B:C ratio as compared to15cm x 10cm and 10cm x 10cm spacing.While higher number of panicle/m$^2$ and straw yield were recorded under 10cm x 10cm spacing. Among the different nutrient levels, application of 150 per cent RDF produced the highest number of panicle/m$^2$, panicle length, panicle weight, number of total grains/panicle, number of filled grains/panicle, test weight, grain yield, straw yield and harvest index. Nutrient levels were not found significant with respect to B:C ratio.

**Keywords:** Planting geometry, Nutrient levels, Economic, Yield attributes, High zinc rice

## INTRODUCTION

Rice is most important staplefood crop for half of the world population. High zinc rice contains more than 24 ppm zinc.Efforts arerequired to increase low yield of high zinc rice per unit area to meetenough zinc to eliminate "hidden hunger," and food requirements of over growing population of the world. The most common reason for high Zn deficiency in humans is inadequate dietary zinc intake, particularly in the regions where cereal based foods are the major source of calories (Virk*et al.*, 2007). Zinc deficiency in human body causes undesirable consequences including growth retardation, dermatitis, impaired immune functioning, hypogonadism, delayed wound healing and poor mental development (WHO, 2002). Thus, growing of high zinc rice can make the difference between illness and a healthy life for millions of people around the world, and productive life.

The yield of rice can be increased through improved agronomic manipulations such as proper spacingand judicious use of fertilizer (BARI, 1995). The optimum spacing ensures the plant to grow in their both aerial and underground parts through efficient utilization of solar radiation and nutrients (Miah*et al.*, 1990). The plant to plant and row to row distance determines the plant population unit-$^1$ area which has direct effect on yield. Closer spacing hampers intercultural operations, more competition arises among the plants for nutrient, air and light as a result plants become weaker and thinnerand consequently, and yield is reduced. So, it is most importance to determine optimum spacing for maximizing the yield of high zinc rice. Rice is one of the least fertilizer use efficient crop. Results of several studies have indicated that application of fertilizers increasegrain yield of rice by increasing the magnitude of its yield attributes( Panda*et al.*, 1995). Increase in yield attributing characters is associated with better nutrition and increased nutrient uptake which result in better and healthy plant growth and development (Kumar and Rao, 1992) leading to greater dry matter production and its translocation to the sink. Grain yieldof high zinc rice increased due to increased N,P and K uptake in responseto external supply of N,P and K fertilizers. Therefore, present investigation was carried out to find out effect of spacing and nutrient levels on grain yield, yield attributes and economics of high zinc rice.

## MATERIAL AND METHOD

The proposed investigation was conducted to study the performance of crop management practices on yield, yield attributes and economics of high zinc rice. The experiment laid out at Research cum Instructional farm, I.G.K.V., Raipur, during *kharif* season of 2013. This site is located at 21$^0$ 4' North latitude and 81$^0$ 35' East longitude with an altitude of 290.2 meters above the mean sea level. The experimental soil was vertisols, neutral in reaction, low in available nitrogen and medium in available phosphorus and potassium content. Climate of this region is sub-humid with an average annual rain fall of about 1200-1400 mm and the crop received 1413.6 mm of the total rainfall during its crop growth. The weekly average maximum and minimum temperature varied in between 27.9$^0$C to 33$^0$C and 16.6$^0$C to 25.3$^0$C, respectively. The treatments consisted oftwo factors included in the experiment were as follows: Plant spacing-3 (i) 10cm × 10cm (S 1) (ii) 15cm × 10cm (S2), (iii) 20cm × 10cm (S3), nutrient levels-3 (i) 50%RDF (F1), (ii)

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100%RDF (F2), (iii)150%RDF(F3). The experiment was laid out in factorial randomized blockdesign with four replications. The test variety was R-RHZ-1 which was short duration. Recommended level of nutrient was 80:50:30 kg NPK/ha. Nutrients were applied as per the treatments of the investigation. The entire amount of Phosphorus and Potash and half dose of Nitrogen were applied as basal and remaining half dose of Nitrogen was applied in two equal splits viz. 25 per cent at active tillering and 25 per cent at panicle initiation stage. The Nitrogen, Phosphorus and Potash were applied in the form of urea, single super phosphate and muriate of potash, respectively. Transplanting of two or three seedlings/hill was done at the spacing of 10cm x 10cm, 15cm x 10cm and 20cm x 10cm spacing, respectively as per treatment. Crop was transplanted on 27.07.2013 and harvested on 20.10.2013. Normal cultural practices weregiven to all the treatments equally.Five plants in each treatment wererandomly selected for observation. The pre-harvest observation such as, plant height, number of tillers/m$^2$, dry matter accumulation and post-harvest observations such as, number of effective tillers/m$^2$ , panicle length, panicle weight, number of spikelets/panicle, number of filled grains/ panicle, test weight , grain yield, straw yield and harvest index were recorded and analyzed statistically.

## RESULT AND DISCUSSION

### Yield attributes

The yield attributing characters significantly varied due to different spacing. The highest panicle length (24.9), panicle weight (4.22), number of total grains/panicle (176),number of filled grains/panicle (139)and test weight(26.04) was noticed with the 20 cm x 10cm spacing which might be due to fact that wider spacing provide efficient use of nutrient and available resources with less competition(Kandil*et al.*2010and Pol*et al.* 2005). While 10cm x10cm spacing gave significantly the highest number of panicle/m$^2$ (356) only which might be due to higher plant population per unit area.Similar results have been reported by Siddiqui*et al*. (1999) and Gorgy (2010). Spacing of 15cm x10cm produced intermediate number of panicles/m$^2$ and number of total grains/panicle with significant difference. The lowest value of yield attributing characters except number of panicles/m$^2$ was obtained under10cm x10cm spacing.

The application of 150 per cent RDF produced significantly the highest number of panicle/m$^2$, panicle length and panicle weight. Number of panicle/m$^2$ and panicle weight was found at par with that of 100 per cent RDF. The lowest value of panicle/m$^2$,panicle weight and panicle length was observed under the 50 per cent RDF. Number of total grains/panicle, number of filled grains/panicle and test weight were recorded the highest under 150 per cent RDF might have helped in improving the nutrient availability for a prolonged period resulting more translocation of photosynthates during crop growth and development stages, ultimately it influenced the reproductive stage and resulted in more yield attributing characters(Pandey*et al.*2009). The lowest value of number of total grains/ panicle, number of filled grains/panicle and test weight were recorded under 50 per cent RDF which was found at par with that of 100 per cent RDF.

### Grain yield, straw yield and harvest index

The grain yield and harvest index of rice increased with the increasing the spacing. The spacing of 20cm x 10cm produced significantly higher grain yield and harvest index as compared to closer spacing which was found at par with that of 15cm x 10cm spacing, while straw yield was registered higher under10cm x 10cm spacing which was also found at par with15cm x 10cm spacing. The lowest grain yield (40.0 q/ha) and harvest index was recorded under 10cm x 10cm spacing which was again found at par with that of 15cm x 10cm spacing. The negative effect of 10cm x 10cm spacing on grain yield could be mainly due to poor translocation of food materials from source to sink.

Grain yield and straw yield of rice was influenced with increasing nutrient levels from 50 per cent to 150 per cent of RDF whereas harvest index was not affected by it. Among the different nutrient levels, application of 150 per cent RDF recorded significantly the highestgrain yield (43.50 q/ha) and straw yield (62.89q/ha). Application of 100 per cent RDF produced intermediate grain and straw yield with significant difference compared to those of 150 per cent and 50 per cent RDF.This may be due to the luxury consumption along with continuous supply of nutrients in the treatments receiving higher dose of nutrients. Similar trend was also observed by GanajaxiMah (2008) and Priyanka*et al*. (2013). The lowest grain yield (38.56 q/ha), straw yield (55.60q/ha) and harvest index was obtained with the application of 50 per cent RDF.

### Economics

The highest gross return,(Rs 59386/ha) net return (Rs.31763/ha) and B:C ratio (2.08 ) were obtained with the spacing of 20 cm x 10cm . Net return was however, at par with that of 15cmx10cm spacing (Rs. 29881/ha).The lowest gross return, net return (Rs. 25784 /ha) and B:C ratio (1.84) was obtained with the spacing of 10cm x 10cm. The highest B:C ratio under the spacing of20 cm x 10cm is due to comparatively lower cost of cultivation, increased straw yield and higher net return. The lowest B:C ratio (1.84) with the spacing of 10cm x 10cm mainly due to comparatively lower grain yield of rice.

The highest gross return (Rs.62284/ha) and net return (Rs.31225/ha was observed with the application of 150 per cent RDF. The lowest Gross return (Rs

54842/ha)andnet return (Rs. 27322 /ha)was recorded with 50 per cent RDF which was however, at par with that of 100 per cent RDF. The more grossand net return was obtained in these treatments were mainly due to higher grain and straw yield and comparatively less cost of cultivation. Nutrient levels were not found significant with respect to B: C ratio.

**Table 1.** Yield attributes of high zinc rice as influenced by spacing and nutrient levels.

| Treatment | No of panicles /$m^2$ | Panicle length (cm) | Panicle weight (g) | Total no. of grains /panicle | No. of filled grains/ panicle | 1,000 grain weight (g) |
|---|---|---|---|---|---|---|
| **Spacing** | | | | | | |
| $S_1$ (10cm x 10cm) | 356 | 24.1 | 3.77 | 163 | 130 | 25.81 |
| $S_2$ (15cm x 10cm) | 272 | 24.5 | 3.90 | 169 | 132 | 25.83 |
| $S_3$ (20cm x 10cm) | 241 | 24.9 | 4.22 | 176 | 139 | 26.04 |
| **SEm±** | **6.18** | **0.20** | **0.08** | **1.49** | **2.36** | **0.15** |
| **CD (P=0.05)** | **18** | **0.6** | **0.24** | **4** | **7** | **NS** |
| **Nutrient levels** | | | | | | |
| $N_1$ (50% RDF) | 273 | 23.9 | 3.81 | 165 | 125 | 25.68 |
| $N_2$ (100% RDF) | 287 | 24.6 | 3.97 | 169 | 132 | 25.78 |
| $N_3$ (150% RDF) | 308 | 25.3 | 4.11 | 175 | 142 | 26.22 |
| **SEm±** | **6.18** | **0.20** | **0.08** | **1.49** | **2.36** | **0.15** |
| **CD (P=0.05)** | **18** | **0.6** | **0.24** | **4** | **7** | **0.43** |

**Table 2.** Grain yield, straw yield and harvest index of high zinc rice as influenced by spacing and fertility levels.

| Treatment | Grain yield (q/ha) | Straw yield (q/ha) | Harvest index (%) |
|---|---|---|---|
| **Spacing** | | | |
| $S_1$ (10cm x 10cm) | 40.00 | 60.42 | 39.87 |
| $S_2$ (15cm x 10cm) | 40.80 | 59.44 | 40.76 |
| $S_3$ (20cm x 10cm) | 41.75 | 58.46 | 41.65 |
| **SEm±** | **0.44** | **0.39** | **0.33** |
| **CD (P=0.05)** | **1.29** | **1.13** | **0.97** |
| **Nutrient levels** | | | |
| $N_1$ (50% RDF) | 38.56 | 55.60 | 40.94 |
| $N_2$ (100% RDF) | 40.62 | 59.82 | 40.43 |
| $N_3$ (150% RDF) | 43.50 | 62.89 | 40.88 |
| **SEm±** | **0.44** | **0.39** | **0.33** |
| **CD (P=0.05)** | **1.29** | **1.13** | **NS** |

**Table 3.** Economics of high zinc rice as influenced by spacing and nutrient level.

| Treatment | Cost of cultivation (Rs/ha) | Gross return (Rs/ha) | Net return (Rs/ha) | B: C Ratio |
|---|---|---|---|---|
| **Spacing** | | | | |
| $S_1$ (10cm x 10cm) | 31244 | 57332 | 25784 | 1.84 |
| $S_2$ (15cm x 10cm) | 29809 | 58579 | 29881 | 1.97 |
| $S_3$ (20cm x 10cm) | 28659 | 59386 | 31763 | 2.08 |
| **SEm±** | **-** | **979** | **736** | **0.03** |
| **CD (P=0.05)** | **-** | **NS** | **2149** | **0.10** |
| **Nutrient level** | | | | |
| $N_1$ (50% RDF) | 27664 | 54842 | 27322 | 1.99 |
| $N_2$ (100% RDF) | 29705 | 58171 | 28881 | 1.96 |
| $N_3$ (150% RDF) | 32342 | 62284 | 31225 | 1.93 |
| **SEm±** | - | **979** | **736** | **0.03** |
| **CD (P=0.05)** | - | **2859** | **2149** | **NS** |

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RESEARCH ARTICLE

# WILD INTOXICATING PLANTS AND THEIR DIETARY FORM IN THE BASTAR REGION (CHHATTISGARH) AMONG THE NATIVE TRIBAL'S

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**Abstract:** This paper compiles and evaluates the ethnobotanical study on wild intoxicating plants and their dietary form in the Bastar region (Chhattisgarh) among the native tribal's which are traditionally used for their consumption. The intoxicating plant species from Bastar district were reviewed, together with their Local names, Family, Habit, Dietary form and Ethnomedicinal uses. A total of Eight plant species belonging to Six families were recorded. We studied data on the botanical families to which the plants belonged also their utilization for the medicinal purposes. This paper highlights the traditional knowledge on the intoxicating edible plants that has remained in rural Bastar. Until recently, many wild plants were used as dietary supplements. However, most of this knowledge survives only in the memory of the elderly, and will probably disappear in a few decades.

**Keywords:** Ras, Tadi, Farsa, Salphi, Bastar Beer, Adivasi, Tribal's

## INTRODUCTION

Humans around the world have been depended on wild-growing plants in their diet for hundreds of thousands of years and will continue to rely on these species to meet at least part of their daily nutritional needs. Wild plant foods include roots, shoots, leaves and fruits etc., use of any of these plants require special cultural knowledge regarding harvesting, preparation, cooking and other forms of processing. Intoxication means the state of being intoxicated, especially by alcohol. Tribal's have a long history of getting the kicks (local word for intoxication) from local plants. Tribals believe intoxication provides excitement and jubilation in their daily life. There has been renewed or increasing interest in consuming wild food plants and their edibility prospects. (nebel 2006). This paper presents case examples of the wild edible plant used for intoxication and their roles in medicinal purposes around the different parts and different cultures and segments of the tribal society of the Bastar.

### Study area

Bastar district is located in the southern part of Chhattisgarh and it is situated at a height of about 2000 ft plateau from sea level. The district has an average population of 1,411644 as per the 2011 census. Of the total population 86 % are rural population in which more than 70 per cent are tribal people like Gond, Dandami Maria, Bison Horn Maria, Muria Dorla, Dhruwa, Bhatra and Halba Tribe, etc. Geography of Bastar District is characterized by its vast natural forest area and prominent rivers. The total forest area of the district is more than 70% i.e. 8029 sq km which is dominated by Sal forest. The Bastar district is abundantly and richly endowed with forest resources.

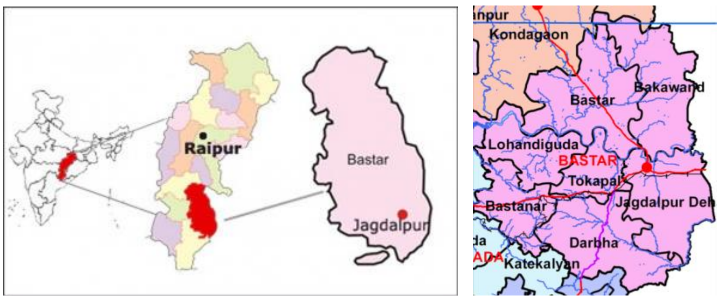


**Fig. 1.** Map of Bastar District.

## MATERIAL AND METHOD

Ethnobotanical data on the uses of 08 plant species were collected through informed consent semi-structured interviews with local informants; the key informants were the age thirty to fifty years. Informants with a sound traditional knowledge of useful wild plants, mostly elderly long-time residents, were interviewed. A semi-quantitative approach was used to document the relative importance of each species and to indicate differences in selection criteria for consuming wild food species in the regions were studied. Open questions about wild food consumption sought to ascertain knowledge about past and present-use, mode of consumption and preparation, collection

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time and collection sites for each species. For this study, data were grouped under their dietary form for the purpose of intoxication and ethnomedicinal uses utilized by those plants.

## RESULT AND DISCUSSION

In the enumeration of all plant species are arranged alphabetically (Table no. 01.). A total of 08 plant species belonging to 06 different families were found for intoxication and ethnomedicinal uses. Arecaceae is found to be the dominant family with 3 plant species followed by Cannabaceae, Clusiaceae, Fabaceae, Graminae and Sapotaceae. The survey indicated that the study area has plenty of intoxicating plants along with medicinal values to treat a wide spectrum of human ailments. The distilled liquor of *Madhuca longifolia* J. Konig (Mahua) is known as "Mand" in the Bastar and the pure form of the liquor is called "Fulli"; in Bastar region almost every Tribal house hold have a small distillation unit for Mahua Mand and is one of major source of economy for many tribal's. The tribals apart from intoxication and medicinal purposes generate a wholesome of revenue by selling the liquior products in their villages. The preservative techniques can be further develop to enhance the preservation techniques which will finally help in the socioeconomic upliftment of the Tribal's of the region adding contribution to the economy of the nation.

## CONCLUSION

The present finding indicates that the tribal's of the study area have deep connection with local forest plants and have great faith in traditional medicine. Due to the constant association with the forest environment and in the absence of any other medical facility available to them in their localities, the tribes of these regions possess good knowledge of herbal drugs. The tribal's of the region uses many plant products for fulfilling their need of alcohol; being poor they generally depend upon they natural solutions for fulfilling their needs. The plants studied and observed were also found to be of great medicinal values, apart from their use in alcoholism they are used in low cost natural medicinal treatments.

Bastar region is very rich in medicinally useful forest, therefore these selected ethnobotanical plants which have medicinal importance needs conversation and these tree species must be conserved by promoting its plantation to protect it from over exploitation. Local ethnobotanical knowledge must be preserved by proper documentation, so that our future generation can be benefited and knowledge received from them will be very useful for researchers in future study.

**Table 1.** Ethnobotanical and Ethnomedicinal Uses of Trees by Tribals of Bastar District, Chhattisgarh.

| S No. | Botanical Name | Local Name | Family | Habit | Dietary Form | EthnoMedicinal Uses |
|---|---|---|---|---|---|---|
| 1. | *Borassus flabellifer* L. | Tad | Arecaceae | T | The inflorescence sap is consumed as liquor known as "Tadi ras". The sap is extracted for the tree in the morning and evening hour's and are consumed fresh. | Tadi ras (inflorescence sap) is assumed as highly proteinous in nature, so it is consumed during Malnutrition and used as coolant. |
| 2. | *Butea monosperma* Lam. | Farsa (H), Palas | Fabaceae | T | The intoxicating sap is obtained from the fresh mature flowers and is generally collected and consumed in fresh form. | 'Farsa ras' is used in treatment of Stomach disorders and generally because of its high sweetness used as an alternative for sugar in many parts of the villages. |
| 3. | *Cannabis sativa* L. | Bhang, Ganja | Cannabaceae | H | The fresh leaves are pounded with Milk and are drunk to intoxicate. | The drink is used in disorders of stomach. |
| 4. | *Caryota urens* L. | Gargamarra (M), Mari, Salphi | Arecaceae | T | The inflorescence sap is known as "Salphi" in Bastar. It is worldwide intoxicating liquid known as "Bastar Beer". The freshly obtained sap is used for consumption, after some hour's fermentation starts and the juice gets sour in taste. | It is used as coolant as well as in treatment diarrhoea in bastar by the local tribal's. |
| 5. | *Coix lacryma-jobi* L. | Kans, Kasa (H) | Graminae | H | The liquor is obtained by fermenting the seeds of the plants | The flour obtained by grinding the dried seeds is used as the alternative of wheat flour. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. | *Madhuca longifolia* J. Konig | Garang, Idukmara , Idum (M); Mahu, Moda, Tora (H); Mahua | Sapotaceae | T | Liquor is obtained by the processing and distillation of fermented Mahua flowers. The distilled liquor of Mahua is known as "Mand" and the pure form of the liquor is called "Fulli". in Bastar almost every Tribal house hold have a small distillation unit for Mahua Mand and is one of major source of economy for many tribal's. | The fresh flowers are used in the treatment of malnutrition as the flowers are of highly proteinious in nature. |
| 7. | *Phoenix sylvestris* L. | Chind (H, M); Indi (M) | Arecaceae | T | The inflorescence sap is a very widely used intoxicating liquor known as "Chind ras". After Salphi; Chind ras is widely used in intoxication. | The sap is used as coolant during summer days. |
| 8. | *Garcinia indica* L. | Dokrakand (H), Choisy, Kokum Ras | Clusiaceae | T | 'Raaga' a intoxicating drink made by fermentation of the fruit. | It is used as a coolant juice. |

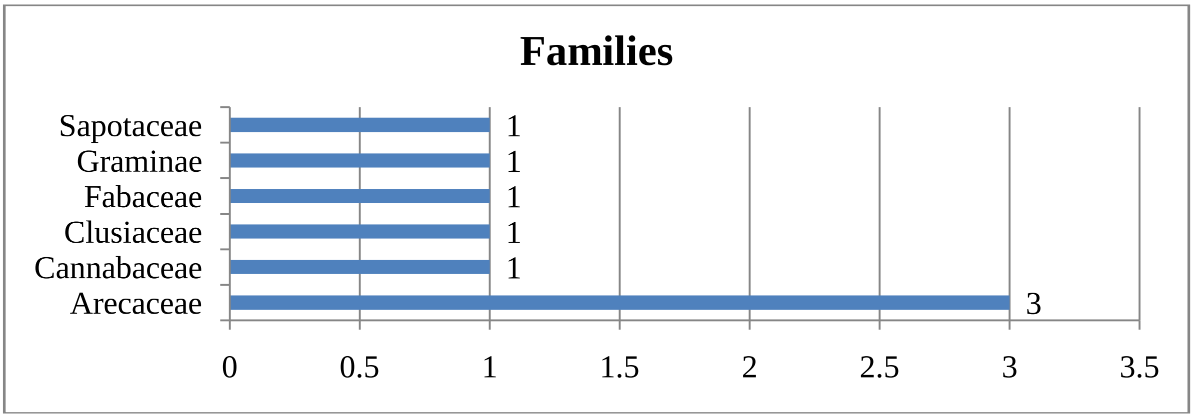


**Fig. 2.** Systematic family wise distribution of the plant species.

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RESEARCH ARTICLE

# *IN VITRO* EFFICACY OF FUNGICIDES AGAINST MAJOR SOIL BORNE PATHOGENS OF GROUNDNUT

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**Abstract:** Efficacy of two non systemic (thiram and mancozeb) and three systemic fungicides (carbendazim, tebuconazole and carboxin+thiram) each at five different concentrations were tested against *Aspergillus niger, Sclerotium rolfsii* and *Rhizoctonia bataticola* under *in vitro* conditions. Among the five fungicides tested mancozeb, tebuconazole and carboxin+thiram gave 100% inhibition against all the three test pathogens. Carbendazim was ineffective against *Sclerotium rolfsii* at 1000 ppm. Thiram showed 100% inhibition against *Rhizoctonia bataticola at* 5000 ppm.

**Keywords:** *Aspergillus niger, Sclerotium rolfsii, Rhizoctonia bataticola,* systemic and non systemic

## INTRODUCTION

Groundnut is a major legume and important oil seed crop in India. In Rayalaseema region it is grown both under *kharif* and *rabi* seasons. Soil borne diseases have been recognized as one of the major factors limiting groundnut production. Among soil borne pathogens, *Aspergillus niger*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* have been reported to be major limitations. These pathogens attack groundnut plants at all stages and cause pre emergence rotting in seeds, soft rot in emerging seedlings and collar rot, stem rot and dry root rot in mature plants. Keeping in this view an attempt was made to find out the suitable fungicides against three pathogens under *in vitro* conditions

## MATERIAL AND METHOD

*In vitro* efficacy of five fungicides (two contact fungicides *viz.*, mancozeb and thiram, and three systemic fungicides *viz.*, carbendazim, carboxin+thiram and tebuconazole) each with five different concentratons @ 1000, 2000, 3000, 4000, 5000 ppm against *Aspergillus niger*, *Sclerotium rolfsii* and *Rhizoctonia bataticola*. were evaluated by following poisoned food technique (Nene and Thapliyal, 1993).

To 50 ml of sterilized distilled water, required quantity of fungicide was added and mixed thoroughly. This solution was added to 50 ml of sterilized cool molten double strength PDA medium, mixed thoroughly and poured into Petri plates. Six mm discs of four days old culture of pathogen were inoculated at the centre of Petri plates and then incubated at 28 ± 2°C. Three replications were maintained for each fungicide. Medium without fungicide was kept as control. Per cent inhibition of the growth of the fungus over the control was calculated using the formula:

$$I = \frac{C - T}{C} X100$$

where,
I = Per cent inhibition in growth of test pathogen
C = Radial growth (mm) in control
T = Radial growth (mm) in treatment.

## RESULT AND DISCUSSION

Against *Aspergillus niger*, all the five fungicides were found equally effective by giving 100 % inhibition at all the concentrations tested. Charitha Devi and Prasad (2009) reported the inhibitory effect of captan and mancozeb on mycelial growth of *A. niger* using poisoned food technique in groundnut.

**Table 1.** *In vitro* efficacy of fungicides against *Aspergillus niger* in poisoned food technique

| S. No. | Fungicides | Concentration (ppm) | Mycelial growth of pathogen (cm)* | Per cent inhibition over control | Mean |
|---|---|---|---|---|---|
| 1 | Mancozeb | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 2 | Thiram | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |

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| | | | | | |
|---|---|---|---|---|---|
| 3 | Carbendazim | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 4 | Carboxin+Thiram | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 5 | Tebuconazole | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| | Control | - | 9.0 | - | - |

* Mean of three replications

Against *Sclerotium rolfsii*, except carbendazim, all other test fungicides gave 100% inhibition at all the tested concentrations. Carbendazim was ineffective at 1000 ppm as the pathogen has completely grown (9 cm) like that of control plate. Carbendazim showed increased inhibition of 4.11% to 51.88% with increasing concentration from 2000 ppm to 5000 ppm with a mean inhibition of 25.77 per cent. Patibanda *et al.* (2002) and Rakholia and Jadeja (2010) reported the inhibitory effect of *S. rolfsii* by carboxin using poisoned food method.

Gour and Sharma (2010) and Rakholia and Jadeja (2010) reported the significant inhibitory effect of tebuconazole and hexaconazole on mycelia growth of *S. rolfsii*. Similarly Deepthi (2014) showed reduced mycelial growth of *S. rolfsii* by using mancozeb in groundnut.

**Table 2.** *In vitro* efficacy of fungicides against *Sclerotium rolfsii* in poisoned food technique

| S. No. | Fungicides | Concentration (ppm) | Mycelial growth of pathogen (cm)* | Per cent inhibition over control | Mean |
|---|---|---|---|---|---|
| 1 | Mancozeb | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 2 | Thiram | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 3 | Carbendazim | 1000 | 9.0 | 0.0 | 20.6 |
| | | 2000 | 8.6 | 4.1 | |
| | | 3000 | 8.0 | 11.1 | |
| | | 4000 | 5.7 | 36.0 | |
| | | 5000 | 4.3 | 51.8 | |
| 4 | Carboxin+Thiram | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 5 | Tebuconazole | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| | Control | - | 9.0 | - | - |
| | S. Em ± | | | 0.57 | |
| | C.D (0.05) | | | 1.63 | |

* Mean of three replications

For *Rhizoctonia bataticola*, mancozeb, carbendazim, carboxin+thiram, tebuconazole showed 100% inhibition at all the five concentrations tested. Thiram showed increased inhibition of 74.44% to 93.33% with increased concentrations of 1000 to 4000 ppm, whereas at 5000 pm it completely inhibited the mycelial growth of pathogen by giving 100% inhibition.

Similar findings were observed by Khan and Gangopadhyay (2008) where carbendazim and thiram were highly inhibitory to the growth of *Rhizoctonia bataticola* causing root rot disease.

**Table 3.** *In vitro* efficacy of fungicides against *Rhizoctonia bataticola* in poisoned food technique

| S. No. | Fungicides | Concentration (ppm) | Mycelial growth of pathogen (cm)* | Per cent inhibition over control | Mean |
|---|---|---|---|---|---|
| 1 | Mancozeb | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 2 | Thiram | 1000 | 2.3 | 74.4 | 85.9 |
| | | 2000 | 1.8 | 79.6 | |
| | | 3000 | 1.6 | 82.2 | |
| | | 4000 | 0.6 | 93.3 | |
| | | 5000 | 0.0 | 100 | |
| 3 | Carbendazim | 1000 | 0.0 | 0.0 | 100 |
| | | 2000 | 0.0 | 0.0 | |
| | | 3000 | 0.0 | 0.0 | |
| | | 4000 | 0.0 | 0.0 | |
| | | 5000 | 0.0 | 0.0 | |
| 4 | Carboxin+Thiram | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| 5 | Tebuconazole | 1000 | 0.0 | 100 | 100 |
| | | 2000 | 0.0 | 100 | |
| | | 3000 | 0.0 | 100 | |
| | | 4000 | 0.0 | 100 | |
| | | 5000 | 0.0 | 100 | |
| | Control | - | 9.0 | - | - |
| | S. Em ± | | | 0.46 | |
| | C.D (0.05) | | | 1.25 | |

* Mean of three replications

## CONCLUSION

Among the five fungicides tested mancozeb, tebuconazole and carboxin+thiram gave 100% inhibition against all the three test pathogens. Carbendazim was ineffective against *Sclerotium rolfsii* at 1000 ppm. Thiram showed 100% inhibition against *Rhizoctonia bataticola at* 5000 ppm.


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RESEARCH COMMUNICATION

# BIOLOGY OF MULBERRY SILKWARM, *BOMBYX MORI* L. IN CHHATTISGARH STATE

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**Abstract:** A study was undertaken on biology of mulberry silkworm *Bombyx mori* L. under laboratory condition at 20-28$^0$C temperature and 50-69% relative humidity till two successive generations. The incubation period was 6.80 days 7.20 days, larval period instarwise 3.63, 3.30, 5.30, 6.50 and 7.50 days with total larval period 26.23 days in first generation. In second generation the larval period was 4.50, 3.53, 5.50, 6.80 and 8.85 days with 28.63 day total larval period. Prepupal and pupal period period 1.20, 11.56 days and 1.43, 11.70 days in first and second generation respectively. The longevity of adult was recorded 4.94, 4.71 in female and 3.12, 3.53 days in male during first and second generation respectively.

**Keywords:** Insect, Temperature, Laboratory, Mulberry

## INTRODUCTION

In nature insect produce difference products like silk, honey, wax, shellac, paints, medicine etc. among these silk production is gaining importance (Annonymous 1972) Silk the end product of sericulture industry occupies a prestigious place among all the fibers. It is one the strangest fibers, two third as strong as steel wire with good dye ability durability and draping qualities (Ramana 1987) Biology of silkworm plays an important role is the rearing of silkworm. Silkworm by nature one quite delicate and very sensitive to environmental condition. Chhattisgarh has huge potential to adopt sericulture. Considering this rearing with hybrid bivoltine NB4 D2x KA of mulberry silkworm were conducted to the biology performance.

## MATERIAL AND METHOD

The mulberry (*Morus indica*) variety K-2 was grown in the vicinity of experimental site. All the laboratory appliances sterilized daily with formalin (2%). The eggs of *Bombyx mori* L. race NB4D2xKA bivoltine were obtained from District Sericulture office Raipur. The egg masses of mulberry silkworm (*Bombyx mori* L.) were maintained in the laboratory condition. Observation was recorded in the egg stage. The larvae were reared in rearing trays after hatching of eggs mass of *Bombyx mori* L. Provide daily four times fresh tender leaves to different instars of *Bombyx mori* L. The observation was recorded in the egg, larval, pupal and adult stages of *Bombyx mori* L.

## RESULT AND DISCUSSION

Findings of the observation data on the biology of *Bombyx mori* L. are depicted in table 1.0. The egg period fluctuated between 6.8 to 7.2 days in first and second generation respectively. Roychaudhury *et al.* (1991), Alarez (1993) and Silayach and Khokhar (1995) studied variation in the egg period due to meteorological parameters.

Larval duration for first, second, third, fourth and fifth instar were recorded 3.63, 3.30, 5.30, 6.50 and 7.5 days in the first generation and 4.5, 3.53, 5.50, 6.80, and 8.50 days in second generation. The total larval period was recorded 26.23 and 28.63 days in first and second generation. Influence of temperature on the developmental period of silkworm vary distinct between the two generation observation. This conclusion also been confirmed by Alvarez (1993) who taken observation at Columbia which is the place of winter in such cool place he had recorded total larval period of 33.0 days.

Prepupal and pupal period were recorded 1.20 and 11.56 days in first generation and 1.43 and 11.70 days in second generation Khrishnaswami *et al.*(1978) reported that the pupal period observed 8-14 days. Alvarez (1993) reported 15.40 days and Koilpillai (1995) reported 10-11 days. These findings of workers are close confirmation with the present findings. The adult longevity of is in female and male was recorded 4.94 and 3.72 days in first generation and 4.71 and 3.53 days in second generation this findings is in agreement with that of Krishnswami *et al.* (1978) who reported the adult longevity 6-10 days in univoltine 3-6 days in multivoltine. Silayach and Khokhar (1995) reported longevity of male ranged between 5.48 – 6.98 days in male and 6.58-7.03 days in female. The difference of male and female longevity may be due to quality of host plant and racial characters.

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**Table 1.** Life cycle of Mulberry silkworm, *Bombyx mori* L.

| S.N. | Stages | Duration in days | |
|---|---|---|---|
| | | I^st^generation | II^nd^generation |
| 1 | **Egg stage** | | |
| | Egg period | 6.80 | 7.20 |
| 2 | **Larval stage** | | |
| | I^st^instar | 3.63 | 4.5 |
| | II^nd^instar | 3.30 | 3.53 |
| | III^rd^instar | 5.30 | 5.50 |
| | IV^rh^instar | 6.50 | 6.80 |
| | V^th^instar | 7.5 | 8.50 |
| 3 | **Pupal stage** | | |
| | Prepupal | 1.16 | 1.43 |
| | Pupal | 11.56 | 11.70 |
| 4 | **Adult longivity** | | |
| | Male | 3.72 | 3.53 |
| | Female | 4.94 | 4.71 |

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