DISCUSSION
This chapter vividly describes the interpretation part of results with the help of available recent literature on the topic. Application of nutrients through organics and inorganic improve the crop productivity and soil health. Therefore, the present investigation was undertaken to study the Effect of integrated plant Nutrient Management (INM) on soil and yield of mustard in alluvial soil of eastern U.P. " The results obtained during the course of investigation have been discussed systematically here in under appropriate heads:

5.1 PHYSIOLOGICAL CHARACTERS:

5.1.1 Leaf area index (LAI):

Data presented on LAI at 60 DAS clearly revealed that all the treatments were found significantly superior over control. Maximum LAI was recorded under treatment supplied 100% NPR +FYM+ S. This might be because of adequate supply of required nutrients and better soil environment under these treatments, which increased photosynthesis, promotes the metabolic activities and accelerates cell division, ultimately increase the growth and development of leave in terms of LAI. These results collaborates with the findings of Dubey and Khan (1993) and Singh and Singh (1997).

5.1.2 Chlorophyll content in leaves:

Among various treatments highest chlorophyll content was found with the application of 100% NPK + FYM + S followed by 50% NPK +FYM +S. The increased chlorophyll content under the FYM and S treated plot was due
to enhanced photosynthesis, nitrogen metabolism, transformation of carbohydrates and oxidation-reduction process in plants. Abraham (2000) also reported similar results in such investigation.

5.2 AGRONOMICAL STUDIES:

5.2.1 Primary and secondary branches:

At 60 DAS number of primary branches were non significant but at 90 DAS all the treatments were found significantly superior over control. Maximum primary branches at 60 and 90 DAS were recorded in the treatment supplied 100% NPK+NPK+FYM+S. This might be due to sufficient supply of required nutrients and soil environment under this treatment T9. Availability of nutrients in adequate amount resulted sufficient formation of meristematic tissues, ultimately enhance the number of branches. These results are inconformity with the findings of Solanki et al. (1998) and Mandal and Sinha (2002). Further it is evident that secondary branches were also maximum with treatment consisting 100% NPK+FYM+S. All the treatments were found significantly superior over control. Similar branching pattern was observed as recorded for primary branches. In general the branching system was more pronounced with treatments having 100% NPK as compare to 50% NPK treatments. This may be ascribed due to more supply of plant foods and its translocation in growing parts of plants with 100% recommended NPK. Ram et al. (1999) also reported improved branching pattern with recommended dose of NPK along with secondary nutrients and organic manures.

5.2.2 Plant height:

Plant height was significantly enhanced by the integrated nutrient management system over control. Maximum increment in plant height was
recorded under treatment s consisting FYM either alone or in combination with S or B at fertility levels. Increase in plant height may be attributed due to the fact that higher nutrient absorption and beneficial effect causing accelerated rate of photosynthesis, assimilation, cell division and vegetative growth. These results are in agreement with the findings of kumar et al, (2002) and Mandal and sinha (2002).

5.2.3 Numer of silique plant\(^{-1}\), seeds silique\(^{-1}\) and test weight: 

Number of silique plant\(^{-1}\) seed silique\(^{-1}\) and test weight influenced by various INM modules revealed that maximum number of silique plant\(^{-1}\) seeds silique\(^{-1}\) and test weight were recorded with the application of 100% recommended dose of NPK along with FYM and S. All the treatments were found significantly superior over control. Increased number of silique plant\(^{-1}\), seeds silique\(^{-1}\) and test weight with the se treatments could be explained on the basis of balanced nutrient supply which enhances cell division, photosynthesis and later on converted into reproductive phase resulted more number of silique plant-1, seeds silique-1 and test weight. Similar findings were also reported by kumar et at, (2002) and Mandal and Sinha (2002).

5.2.4 Seed and stover yield of mustard:

Seed and stover yield of mustard was significantly influenced by integrated plant nutrient management system. Maximum increment in seed and stover yield was observed in treatment supplied 100% NPK along with FYM and S. The increase in seed and stover yield may be due to improved in yield attributes, morphological and biological character and better translocation of photosynthetic from source to sink. These results collaborates with the findings of singh and Nad (2002) and Fauri shankar et al. (2002). Treatments consisting 100% NPK were found superior in seed and stover yield.
yield or mustard comparison to treatment consisting 50% NPK this may be due to stimulated Growth which produce photosynthetic, surface and assimilation for all round development of reproductive structure which ultimately enhanced the yield attributing characters in treatment of 100% NPK. Gauri Shankar et al. (2002) also reported similar findings.

5.2.5 Harvest Index:

It is obvious that harvest index of crop was affected by the integrated plant nutrient management. The maximum increment in harvest index was noticed under treatment consisting FYM either alone or S combination with other nutrient sources at both fertility levels. This may be due to translocation of photosynthetic from vegetative parts to seed yield in total biological yield, ultimately increase the harvest index of the crop. These results collaborates with the findings of kumar et al. (2002).

5.3.1 Oil and protein content in seeds:

Data pertaining to Oil and protein content of seals as affected by nutrient management revealed that maximum oil content in seeds was observed with treatment consisting 100% NPK+FYM+S. Individually B did not increase the oil content of seeds significantly over 100% NPK at fertility levels. The increased oil content with FYM and S may be due to the synthesis of more glucosides. Guri Shankar et al. (2002) and Singh and Nad (2002) also observed similar findings, and reported that FYM and S increased the oil content in mustard seeds. Further it so noticed that protein content in seeds increased with the treatments consisting NPK along with other nutrient sources. The maximum protein content in seeds with treatments consisting 100% NPK+FYM+S may be because of higher N utilization by the crop. Which enhance the protein synthesis in plant and ultimately increased the
protein content in mustard seeds by increasing the osmophyllic bodies and formation of amino acids. Abraham (200) and Narwal et al (2000) also reported similar findings.

5.4 PLANT ANALYSIS:

5.4.1 Nutrients concentration in plant:

Among various growth stages, the maximum N,P,K, and B content in plant were at 60 DAS, which reduced progressively towards the maturity of crop. The decrease in nutrient contents at advance stage of crop may be due to dilution effect and increased dry matter. There was significant increase in nitrogen content observed with FYM and S either alone or in combination with FYM+S at fertility leaves. Alone application of S+FYM did not improve the N content at fertility levels, but along with FYM improved N content was observed significantly over 100% NPK. The concentration of N was slightly higher with 100% NPK in comparison to 50% dose of NPK. This can be explained on the basis of adequate supply of these elements and their absorption by the crop at optimal level of fertilizer alone as well as in combination with FYM, S,B.

Similarly significant improvement in phosphorus content in plant was observed in all treatments over control at all growth stages of crop. Significant improvement in plant P content was noticed under treatments consisting FYM and S either alone or in combination with other nutrient sources at fertility level. This may be due to application of FYM and S which, produces organic and weak acids, ultimately increases its absorption by plant. These results are in accordance with the findings of Rant et al (2002).

The maximum potassium content in plant was recorded at 60 DAS, which reduces towards the maturity of crop this may be due to dilution effect
and increase towards the maturity of crop. All the treatments were found significantly superior over control at all growth stages of crop increase in potassium content was due to its deficient supply from soil to plant. These findings are also in accordance with the results obtained by Singh an Nad, (2002).

Further various INM modules affected the S content in plants at all growth stages of crop. The highest S concentration was with 100% NPK+FYM+S followed by 50% NPK+FYM+S Application of FYM or S either alone or in combination, increases the S content in plants significantly. Increase in S concentration with S and FYM treated plots can be ascribed to increase S status in soil resulted increase in S concentration of plants. Sakal et al. (2002) also reported result another findings.

Effect of various INM modules showed that highest B content in plant was with treatment supplied 100% NPK +FYM + B followed by 50% NPK+FYM+B at all growth stages of crop. The increase in B content with B and FYM treated plots might be because of improved native as well as added B availability in soil at all growth stages.

5.4.2 INM on uptake of N,P,K, S and B:

Data with respect N,P,K,S and B uptake by mustard seeds as well as stover indicates that significant improvement in N uptake was noticed under treatments consisting FYM along with B,S at fertility levels. Alone application of B &S at fertility levels did not improve the N uptake. The enhanced N uptake may be due to adequate availability of this nutrient in soil which increase the N absorption by the plants ultimately increase the n content in seeds and stover and total biological yield also affected the N
uptake. These findings are in accordance with the result obtained by Mandal and Sinha (2002).

Data also shows that phosphorus uptake increased within creasing levels of NPK and addition of FYM and S. This may be due to formation of weak acids during decomposition of FYM and S. This may be due to formation of weak acids during decomposition of FYM and S also form acid which converts the complex forms of phosphorus in to soluble form. Availability of phosphorus increases its content in plant and total biological yield, which ultimately increases the phosphorus uptake. These results are in agreement with the findings as reported by Singh and Nad (2002)

The INM systems also affected the S and B uptake by the crop. Highest S uptake noticed in treatment receiving 100% NPK + FYM + S. Application of FYM or S either alone or in combination with both fertility levels enhanced the S uptake significantly over 100% NPK level. The increase in uptake by the crop of mustard may be due to increase in their content in seeds and stove as well as total biological yield because uptake is the byproduct of biological yield and concentration of nutrients. Further it is evident the application of 100% recommended dose of NPK and 50% NPK level long with FYM, S and B significantly enhanced the B uptake. Increase in uptake of B by mustard crop with application of FYM and B may be attributed to the additional supply of these nutrients, its content in seeds and stove and total biomass.

5.5 PHYSICO-CHEMICAL PROPERTIES OF SOIL:

5.5.1 WHC and Bulk Density:

WHC and bulk density of soil under influence of different treatments indicates that WHC found increased under all the treatments over its initial
status. The highest WHC of soil was observed in treatment supplied 100% NPK+FYM+S. Application of FYM either alone or in combination with B&S improve the WHC treatments indicates that WHC found increased under all the treatments over its initial status. The highest 100% NPK+FYM+S. Application of FYM either alone or in combination with B&S improve the WHC and reduction in bulk density of soil may be certainly because of improvement of organic matter and porosity of soil under treatment consisting FYM. The result are in resemblance with the findings of Vasanthi and Kumar as wami (1999) and Fauri Shankar et al. (2002).

5.5.2 Soil pH, EC and organic carbon content:

Maximum reduction in pH and EC was noticed under treatment consisting FYM and S, which might be due to the production of acids with sulphur application and organic acids from FYM decomposition resulted reduction in these parameters. The significant improvement of organic carbon content of soil with treatments consisting FYM in comparison to rest of the treatments may ascribed due to additive effect of organic carbon through FYM and addition of plant debris as a result of death and decay of plant leaves. This result closely collaborates with the findings of Santhy et al. (1999) and Kumaran an solaimali (2000).

5.5.3 Availability of N, P, K, and B:

Data on availability of N, P, K, S and B as affected by various In M modules shows that status of available nitrogen in soil decreased in all the treatments except treatments have FYM at optimal dose of NPK. The increments in the availability of N may be due to addition o FYM. The maximum increment of N availability was noticed under treatment having FYM + Sulphur at optimal level of NPK.
Phosphorus status of soil in terms of available P decline in all treatments except treatment having FYM and 100% NPK + increased availability of phosphorus in soil under treatments having FYM at both NPK levels and 10% NPK + may be attributed to increased solubility of native and added phosphorus due to production of organic acids. Similar findings were also observed by the Kumaran and Solaimali (2000).

Various INM modules did not reflect the availability of potassium in soil significantly. Although a slight increase was noticed in treatment having FYM.

Available sulphur reduced in all the treatment except in treatments having FYM and both fertility leaves. Available sulphur content of soil improved under treatments having FYM and S. Increased availability of sulphur in soil may be attributed to increased solubility of native added sulphur through FYM and S. These results closely related with the findings of Bellakki et al. (1999) and Choudhary et al. (2003).

Significant buildup of available B content in soil was observed under treatments having FYM+S either alone or in combination with other nutrient sources at fertility levels. Increase in availability of B in soil may be due to the additive supply of B through FYM and B fertilizer which increases the availability of B.

5.5.4 Total N,P,K, S and B content in Soil:

Data with respect to total N,P,K, S and B content revealed that considerable improvement in total nitrogen of soil was observed under all the treatments having FYM except in treatment 50% NPK + FYM + S. The improvement of total nitrogen at both NPK levels either alone or with S, may be attributed to addition of nitrogen through FYM decomposition.
Similarly phosphorus status in terms of total content of soil enhanced under all the treatments except control over its initial status. Improved total phosphorus content of soil under these treatments may be because of additive effect of inorganic phosphatic fertilizer and FYM, which might be more effective to fix added phosphorus. Further data also shows that total potassium content of soil improved under treatment having FYM at both fertility levels except in treatments 50% NPK + FYM + B. The improvement of total potassium content of soil was due to the addition of potassium through FYM and inorganic fertilizer, which converted into fixed form. These results are conformity with Sharma (1999).

Considerable reduction of total S was noted in all treatments except treatment having S. The decrease in total S content is due to absorption by crops resulted low content. Significant build up of total sulphur over its initial status was observed under treatments having S either alone or along with FYM at both fertility levels. This may be due to addition of S through FYM and S. Powder and their conversion of available from in an unavailable. These results are collaborates with the result of Sharma (1990).

Similarly B status in terms of total B content of soil reduced over its initial status except in treatments having B at both fertility levels. Significant buildup of total over its initial status may be attributed the addition of B in the form of Boron fertilizer and its conversion in to fixed form.

5.6 ECONOMICS OF MUSTARD CROP AS AFFECTED BY VARIOUS INM MODULES:

Net return under various INM modules on mustard revealed that maximum net return was observed when FYM+S was conducted with 100% NPK followed by Boron along with 100% NPK level. Similar trend was observed with respect to cost: benefit ratio of crop. Application of 50% NPK either alone or in combination with other sources of nutrient was lowest as
compared to its corporation with 100% NPK in respect to net return and cost: benefit ratio. The net rectum and cost: benefit ratio increased due to low cost of cultivation and high yield of mustard under treatments having 100% NPK +FYM+S an T₁₀ (50% NPK + FYM+ S) significantly superior over rest of the treatments.

All treatments were found significantly superior over control with respect to secondary branches plant¹ at 60 DAS and 90 DAS a well. Treatment T₉ (50% NPK +FYM+S) was also significantly superior over all the treatments in this regard.

A significant increase in plant height was observed with treatment T₉ (100% NPK+FYM+S) and noted at par with treatments T₁₁ (100% NPK+FYM+B) and T₁₀ (50% NPK +FYM+S). Their plant height was comparatively more with optimal level of NPK against suboptimal dose of NPK. All then treatments were found to be significantly superior over control.

Number of siliqua plat was counted maximum with treatment T₁₁ which was at par with treatments T₉ and significantly superior over rest of the treatments. For this parameter 50% NPK was found inferior as compared to 100% NPK.

Seeds siliqua¹ were counted in treatments T₁₁ and noted at par with treatments T₄ (100% NPK=FYM), T₉ (100% NPK + FYM+ S) and T₁₀ (100% NPK +FYM+S) significantly superior over rest of the treatments. Application of optimal level of NPK was found more effective as compared to sub optimal level of NPK.

Test weight of seeds was also maximum with 100% NPK+FYM+S and significantly superior over all the treatments. All the treatments were also significantly superior over control

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