DISCUSSION
CHAPTER-V

DISCUSSION

Discussion regarding findings during all the three years for different growth, yield attributing and yield characters have been discussed in present chapter.

5.1. Pre harvest observation (Plant growth characters):

5.1.1. Plant population:
Mean plant population under the influence of water regimes and levels of phosphorus were found to be not much varying during individual years. However, due to general, plant population during 1987 being less, yields were also recorded lesser than other two years, in general.

5.1.2. Plant height:
Plant height was studied at 20, 40, 60, 80, 100 DAS and at harvest. Since no irrigation treatments came in operation up to 20th day stage, so no question of variation in plant height due to various water regimes arises, as is reflected by the results. However at this stage during the years 1987 and 1988 a minor variation in height was observed.

During the year 1986 different levels of phosphorus application were not able to bring out any change in plant height at 20th day stage.
During the year 1987, though the maximum plant height was observed with 0 kg P$_2$O$_5$/ha, differences were not much from other higher levels, which may be attributed to the very low requirements of P of the groundnut crop (Reid and Cox, 1973). Possibly during early stages of growth applied fertilizer phosphorus was not absorbed in quantities significantly more than native P in control plot.

During the year 1988 at 20th day stage growth in height was more with higher levels of applied P. Though the result seems controversial to that of 1987, the differences were not much. It may be attributed to the differential absorption of P during early stage of growth.

At 40th days stage during the year 1986 and 1988, again water regimes could not create any significant difference in height. However, during 1987, differences in height were observed to be significant due to various irrigation treatments. During the year 1987, 0.6 + 0.8 and 0.6 IW/CPE irrigation schedules were at par and resulted in taller plants with one irrigation each upto the stage. 1.0 IW/CPE schedule having plots received 2nd irrigation just before a day of observation having no active contribution to the height. So, lag in height for this treatment may be attributed to wider gap.
Variation in height were not observed due to phosphorus levels under study during the year 1986. But during following years, increasing doses of phosphorus expressed variation in height with increasing trends. But the response could not pass over 40 kg $P_2O_5$/ha. Taller plants with higher levels of phosphorus may be due to relatively more absorption and utilization of applied P.

At 60 days stage, no variation in plant height was noted due to different water regimes during the year 1986 and 1988. However, 1987 was the year during which variation in plant height was observed to be significant. Keeping pace with the preceding stage, 0.6 and 0.6 + 0.8 IW/CPE schedule proved their superiority in producing taller plants. 1.0 IW/CPE schedule having more number of irrigation, seems to be suffering from excess moisture condition, resulting in poor soil aeration and in turn, poor plant height. At this stage also, during all the three years under study, increasing levels of phosphorus produced significant taller plants, but during the year 1986, the response was up to 60 kg $P_2O_5$/ha; while during rest two years, it was only up to 40 kg $P_2O_5$/ha, possibly more absorption and utilization of P and its synergistic effect of N absorption and utilization is the reason causing positive increase in height corresponding to increasing levels of P.
Significant variations in plant height were observed at 80 days after sowing also due to various water regime except during 1986. During the year 1987 and 1988, like 60 days stage, 0.6 + 0.8 and 0.6 IW/CPE irrigation schedule produced taller plants. Possible reason for lagging in height under 1.0 IW/CPE water regime may be the same as it was mentioned for 60 days stage. During the year 1986, all the phosphorus levels, tried, were at par, but maintaining the trend of previous stage. During 1987 and 1988, plant height increased up to 40 kg P$_2$O$_5$/ha and the possible reason may be the same as it was quoted for the same at 60 days stage.

At 100 days stage, different water regimes continued to effect the plant height. Continuous increasing height indicates simultaneous vegetative growth overlapping the reproductive phase for a long time as the general habit of the leguminous plants.

Increasing temperature with increasing evaporative demand of the plant at this stage may exert the compensatory effect on plant growth in relation to higher IW/CPE schedules, but the result was not such as to bring the growth up to the equal level. At this stage also during the years 1986 and 1987, 0.6 + 0.8 IW/CPE schedule maintained its superiority. However, during 1988, the trend observed here to was averted and 1.0 IW/CPE was the schedule resulting in
tallest plants. The possible reason may be the availability of more water for better growth with lessened effect of poor aeration due to relatively higher evaporative demand.

As regard the phosphorus level, significant variations at this stage also were noted but with variable trend during the individual years under study. This may be due to minimized effect of P at this stage.

Plant height was also recorded at the time of harvesting. During all the three years under study, significant variations were noted. During 1986 and 1988, tallest plants were observed with 0.6 IW/CPE schedule, while during 1987 the same was found with 0.6 + 0.8 IW/CPE scheduling. Reason may be the optimum availability of soil moisture at the time of need satisfying the evaporative demand of the crop in relatively better way.

Regarding various phosphorus levels, though either 40 or 60 kg P$_2$O$_5$/ha produced the tallest plants, expression of height was not of the same trend during different years. Possible reason may be the decreasing availability and need of P for vegetative growth with increasing age of the plant.

5.1.3. Leaf area index:

LAI indicates the relative coverage of ground and thus is an important parameter of growth. In the present
investigation, LAI was recorded at 35, 55 and 75 days after sowing and at harvest to assess effect of water regimes and phosphorus levels.

At 35 DAS, different water regimes significantly affected the LAI during the year 1986 only. At this stage during 1986, 0.6 + 0.8 IW/CPE schedule had greatest effect on LAI followed by 0.6 IW/CPE schedule. In fact, up to this stage both the treatments giving higher values of LAI the same irrigation schedule of 0.6 IW/CPE. It is possible that other two treatments of irrigation caused excess moisture in root zone soil causing poor aeration; theirby reducing the leaf area.

No variations in LAI were observed due to varying phosphorus levels, which indicates that during early stage no differential absorption of phosphorus corresponding to different phosphorus levels was there. This was perhaps due to the low requirements of groundnut for phosphorus, which was sufficed by the amounts met through native P.

At 55 and 75 days stage and at harvest different water regimes created variation in LAI during the years under study except 1987. The maximum LAI values being the function of number and size of leaves favoured the 0.6 and/or 0.6 + 0.8 IW/CPE schedule. This may be due to optimum water supply in root zone avoiding excess or stress of moisture, resulting in better aeration, absorption of water & nutrients, growth
and number of nodules, resulting in relatively more availability of fixed nitrogen and better crop growth. Results are supported by findings of Nambiar and Dart (1983).

However, no variations, in general, were observed at either of the stages due to varying phosphorus levels, except during 1987 at 75 days stage and at harvest, where maximum LAI was observed with 20 kg P₂O₅/ha indicating the low requirement of phosphorus for the groundnut crop.

5.1.4. Number of nodules:

Number of nodules per plant were recorded at 20, 35, 50 and 65 days after sowing. At all these stages of growth, significant variations in number of nodules were observed during all the three years under study. Highest nodule counts were observed with 0.8 IW/CPE schedule being either at par or followed by 0.6 or 0.6 + 0.8 IW/CPE schedule. Though the nodule number itself is not the sole indication of fixed atmospheric nitrogen, but positive correlations are always possible. The maximum number of nodules in 0.8 IW/CPE schedule indicates the optimum moisture supplies for the nodulation. 1.0 IW/CPE schedule seems to supply excess moisture resulting in low nodule counts (Nambiar and Dart, 1983).
Significant variation in number of nodules/plant were observed at all the stages of growth during all the three years under study. 60 kg $P_2O_5$/ha was the level of phosphorus which recorded maximum number of nodules irrespective of growth stages. Phosphorus plays primary role in root development. Its availability either increases or decreases nodulation and nitrogen fixation. The effect may be on one or all the 3 phases of nitrogen fixation, or the effect may be exerted indirectly through the host plant (Griffith, 1978). In present study, higher number of nodule association with higher level of phosphorus, may be due to higher availability of $P$ to the plant.

Interaction effects due to water regimes and phosphorus level during 1986, differed significantly at 20 and 50 days stage only. This may be due to differential absorption of $P_2O_5$ under the variations in moisture availability. However, during the year 1987, variations in nodule number were significant at all the stages of crop growth. During the year 1988 results were just opposite. This may be interpreted as the differential uptake of phosphorus under the effect of variable moisture content.

5.1.5. Dry weight of nodules/plant:

During the year 1986, variation in dry weight of nodules per plant were observed only at 65 days stage due to
different irrigation schedules. It indicates that though the number of nodules per plant increased, their dry weight did not increase in the same proportions, resulting in non significant variation up to 50 days stage.

During the year 1987, variation in dry weight of nodules was only observed at 50 days stage due to different water regimes, whereas during the year 1988, all the stages of growth expressed variation in nodule weight, except at 65 days stage.

In most of the cases, maximum dry weight of nodules was recorded with 0.8 IW/CPE followed by 0.6 or 0.6 + 0.8 IW/CPE schedule. This indicates that 0.8 IW/CPE provides the adequate amount of moisture for proper nodule development. Excess or stress moisture conditions created by other irrigation schedules may lead the plant to suffer with poor aeration or unavailability of sufficient water and nutrients resulting in poor development of nodules.

No variations in dry weight of nodules per plant were observed due to graded phosphorus levels, except during the year 1986 at 65 days stage. However, in general, highest phosphorus level (60 kg P₂O₅/ha) recorded maximum nodule weight which may be seen in the light of more uptake of phosphorus under the treatment.
5.1.6. **Dry matter accumulation**:

Dry matter accumulation in the plant was recorded at 35, 55 and 75 DAS and at harvest. During the year 1986, all the four irrigation schedules were equally effective in dry matter accumulation up to 35 days stage, but at 55 days after sowing 0.6 IW/CPE schedule closely followed by 0.6 + 0.8 IW/CPE, was observed to have more dry matter than 1.0 and 0.8 IW/CPE schedule. At 75 days stage, lag in dry matter accumulation in 1.0 and 0.8 IW/CPE water regimes was compensated by proportionately more dry matter accumulation which resulted in non significant variation at this stage. Maintaining the trend at harvest, 1.0 and 0.8 IW/CPE schedules surpassed other water regimes in effecting dry matter accumulation.

Since evaporation rates during later stages of crop life were quite high, corresponding growth rate as observed during early stages, resulted in an altered trend. Probably, this was the reason for more dry matter accumulation in treatments having more frequent irrigations at the time of maturity of the crop. Decreased rates of dry matter production due to soil water deficit was also reported by Iilna (1959); Billaz and Och (1961); and Lenka and Mishra (1973).
During the year 1987, no variation in dry matter accumulation was observed up to 55 DAS. However, at 75 days after sowing, 1.0 IW/CPE produced more dry matter than other irrigation treatments. But reaching to maturity stage effectiveness of 1.0 IW/CPE schedule lagged behind 0.6 + 0.8 IW/CPE schedule.

During the year 1988, inconsistent effects at different growth stages were observed due to various irrigation schedules. However, at harvest 1.0 IW/CPE recorded more dry matter accumulation, though the effects of other irrigation treatments were at par. Reasons for irregular effect of various irrigation treatments on dry matter accumulation may be attributed to differential availability and absorption of water under various irrigation treatment.

Graded levels of phosphorus produced variations in dry matter accumulation by the plants at all the growth stages under study, during all the three years, except at 55 and 75 days stage during the year 1987. Almost in all the cases, higher levels of phosphorus produced more dry matter, but the response was only up to 40 kg P2O5/ha. Phosphorus, being an essential element, is thought to be necessary for proper root, nodule and seed development. For this reason, effects of higher levels of phosphorus are reflected in more dry matter accumulation in the plant.
5.1.7. **Number of branches/plant:**

Number of branches per plant varied significantly due to various water regimes during 1986 and 1987. However, during 1988, no significant variation due to different water regimes was observed. 0.6 + 0.8 IW/CPE, being at par with 0.8 IW/CPE schedule, was observed to have maximum number of branches during both the years. This may be due to the fact, that irrigating the groundnut at this very point supplies the water adequate to meet the evaporative demand of the crop, which, in turn by way of having better vegetative growth, have produced more number of branches per plant. Khan and Datta (1982) also obtained same results by adopting irrigation schedule very close to this.

Significant variations in branch number were also observed due to graded phosphorus levels during all the three years. Response being up to 40 kg P$_2$O$_5$/ha was at par with 60 kg P$_2$O$_5$/ha for producing the maximum number of branches per plant. This may be attributed to more availability and absorption of P for giving better growth and increased number of branches. The trend for various levels of phosphorus for producing branches was almost the same during all the three years.

Interaction, **irrigation x phosphorus**, was significant during the year 1987 only. Maximum number of branches at 0.8 IW/CPE combined with 60 or 40 kg P$_2$O$_5$/ha were
the result of adequate moisture supply associated with sufficient amounts of absorbed phosphorus.

5.2. Post harvest observation: (Yield and yield attributes):

5.2.1. Number of pods/plant:

Number of pods per plant registered significant variations due to different irrigation schedules during the year 1987 and 1988, and it was at par during 1986. During the year 1987, 0.8 IW/CPE schedule was best followed by 0.6, 1.0 and 0.6 + 0.8 IW/CPE. The trend was reversed during the year 1988, bringing 0.6 + 0.8 IW/CPE at the top. This leads to the inconsistency in results. Smith (1954) was also of the opinion that number of flowers emerging from the axil of the branches may not determine the number of pods also. In this was what accounts for low percentage of flowers developing into pegs and subsequently into pods is not so clear. One reason for the inconsistent results may be the failure of many pegs to enter the soil due to crust formation on the surface, resulting in the less number of pods, irrespective of moisture content in the soil.

Phosphorus levels were also observed to be effective in bringing out variations in number of pods during all the three years. During the year 1986, no significant variation in number of pods due to 0, 40 and 60 kg P₂O₅/ha was noted.
But during the year 1987 and 1988, number of pods were found increasing with corresponding increase in phosphorus levels. Better availability of phosphorus, resulting in more available fixed nitrogen may be the season for increased number of pods in higher levels of applied P (Reddy and Saibaba, 1983; and Balakrishna Reddy, 1983).

Irrigation x phosphorus interactions were also observed to be significant during the year 1987 and 1988. During both the years, highest number of pods in 60 kg $P_2O_5$/ha + 0.8 IW/CPE irrigation schedule may be attributed to the more available P under adequate moisture supply conditions.

5.2.2. **Pod weight/plant** :

Different water regimes did not register any variation in pod yield per plant during 1986 and 1988, but the significant variation was recorded during 1987. 1.0 IW/CPE schedule dominated in pod yield per plant. This may be attributed to the optimum amounts of available moisture and continuous loose surface of the soil, resulting in easier penetration of pegs and their ultimate development into pods (Smith, 1954).

Effect of graded levels of phosphorus was observed to be non significant during all the years under study.
Interaction, irrigation x phosphorus levels, created significant variation in pod yield per plant during the year 1987 only. 1.0 IW/CPE schedule combined with lower levels of phosphorus produced higher pod yield per plant. The reason may be attributed to the very low requirements of groundnut for P probably met through native P under excess moisture conditions.

5.2.3. Pod yield (q/ha):

Pod yield (q/ha) registered significant variation due to the effect of different water regimes during all the three years under study. 0.8 IW/CPE schedule was observed to be the best pod yielder.

Pod yield per hectare can be interpreted as the function of plant population, number and weight of pods per plant. During the year 1987, more number of pods in 0.8 IW/CPE have led this treatment to the superior most position regarding pod yields, while during 1988, higher pod weight per plant seems the reason for this treatment (0.8 IW/CPE) to yield best. The results are in close proximity with those of Goldberg et al. (1967), Subramaniam et al. (1974), Khan and Dutta (1982), Rao (1982) and Shinde and Pawar (1982). This irrigation schedule (0.8 IW/CPE) seems to avoid excess of stress moisture conditions leading the plant to be able for optimum moisture and nutrients uptake.
Pod yield (q/ha) varied significantly due to different phosphorus levels during all the years under study. During all the years, maximisation in pod yield was the result of 40 kg P₂O₅/ha and higher dose was found to be at par with exception during the year 1986, when significantly decreasing yield levels were obtained with simultaneous stepdown of P levels. During the year 1986, numerical values for number of pods per plant seem to mislead at a glance, but at par values for 0, 60 and 40 kg P₂O₅/ha associated with corresponding values for pod weight per plant having no significant difference, clear the reason for superiority of higher P levels giving ultimate pod yield q/ha. During the years 1987 and 1988, superiority of higher P levels for giving higher pod yields per hectare is the simple function of number and weight of pods per plant for corresponding P levels.

Combined effect of different irrigation and phosphorus levels varied significantly only during the year 1987. This may be attributed to be differential effects of different levels of irrigation and phosphorous on number and weight of pods per plant.

5.2.4. Shelling percentage:

Since the final valuation of the produce is on the basis of kernels, shelling out-turn is an important
consideration. It is dependent upon the thickness of the shell, the development of the kernel and flower pattern during the crop period. It is influenced by the genotype, rainfall distribution and nutrition management, especially calcium in the root zone. 0.8 IW/CPE recorded the highest shelling percentage during all the three years under study as affected by different water regimes. This may be attributed to the optimum moisture supply, because excess available soil moisture (Tamala Reddy, 1974) as well as stress conditions (Stern, 1968) lower the shelling percentage.

Varying phosphorus levels also influenced the shelling percentage significantly. Shelling percentage and corresponding levels of phosphorus maintained the parallel slopes with their decreasing values, 60 kg P$_2$O$_5$/ha being on the top. This may be attributed to the pronounced effects of more available metabolic energy by way of more available amounts of P, resulting in sound kernels.

During the years 1986 and 1988, interaction of two variables under study caused significant variations in the shelling percentage. This may be attributed to the beneficial effect of more available phosphorus under optimum soil moisture conditions on proper filling of the kernels. This suggest that under stress many pods are partly empty and extra weight is transfered to the shell, hence maintaining nearly constant pod weight while reducing shelling percentage (Stern, 1968).
5.2.5. **Shell yields (q/ha):**

Shell yield is governed by the shelling percentage. More the shell yield, lesser will be the shelling percentage. In present study during 1986 and 1988, no significant difference in shell yield was noted due to various water regimes, however, it was affected significantly during the year 1987. 0.6 and 0.6 + 0.8 IW/CPE schedules registered highest shell yield being at par. This may be attributed to the lesser kernel yield under these treatments resulting in more shell yield.

Different phosphorus levels were not found to produce variations in shell yield q/ha. But the interaction effect of two variables was found to be significant during all the years. 0.6 IW/CPE schedule having phosphorus levels of 40 kg P₂O₅/ha was observed to yield maximum shell mass. Relatively moisture stress conditions may not have been able to utilized P at the disposal of the plant, resulting in improper development of pod. Under this condition proper transfer of photosynthate from shell to seed must have decreased resulting in more shell mass.

5.2.6. **Test weight (100 kernel weight):**

Test weight, in general, is governed by geno-type and environment. 0.8 IW/CPE was found to produce heaviest seeds during all the three years. Reason may be the proper
availability of soil moisture and uptake of nutrients, leading to better grain filling. Results were in agreement with the work of Lenka and Mishra (1973), Ishaq (1982), Rao (1982).

Increasing levels of phosphorus resulted in increased test weight of kernels, 60 kg P₂O₅/ha followed by 40, 20 and 0 kg P₂O₅/ha was the trend of response for grain weight accumulation. Reason is very obvious and may be attributed to the role of phosphorus particularly during the phase of grain filling as a consequence of seed material itself and compounds responsible for transfer of metabolic energy (ATP and ADP).

Irrigation x phosphorus levels interactions also affected the test weight significantly during the year 1986 and 1988. During both these years, highest test weight was recorded with plots having 60 kg P₂O₅/ha irrigated at 0.8 IW/CPE schedule. This may be due to the beneficial effect of optimum moisture level coupled with more available P.

5.2.7. Kernel yield (q/ha):

During all the three years, 0.8 IW/CPE registered maximum kernel yield per hectare having significant superiority. This may be attributed to better grain filling under optimum soil moisture conditions. High positive
correlation with pod yield and shelling percentage support the superiority of this irrigation schedule for kernel yield production. Kernel size itself seems to be slightly reduced under stress conditions. Cheema et al. (1974) reported higher kernel weight with irrigation.

5.2.8. Percentage of mature pods:

The percentage of mature pod was found to be unaffected due to different irrigation treatments during all the year under study. However, it differ significantly due to various levels of phosphorus during the year 1987 and 1988 both the years.

During both the years highest percentage of mature pods was obtained in plots where no application of phosphorus was done. This indicates that though total number of pegs may have been produced with higher levels of phosphorus, most of them either were not able to penetrated into the soil or could not developed into filled pods lowering the percentage of mature pods with treatments of higher phosphorus levels.

5.2.9. Haulm yield (q/ha):

Significant variations in haulm yield (q/ha) were observed due to different water regimes. During the year 1986 and 1988, 0.8 IW/CPE registered the maximum haulm yield, which may be attributed to the maintenance of adequate soil
moisture for vegetative growth of the crop. Lenka and Mishra (1973) also found more haulm yields, when the crop was irrigated at 25% or 50% ASMD than at 75% ASMD.

Higher levels of phosphorus also recorded higher haulm yields. This may be due to balanced uptake of nutrients as synergised by more available P. Phosphorus is thought to be beneficial for nodulation and atmospheric N fixation, which under optimum moisture supply may result into the relatively greater leaf size, longer internodes, more number of branches, and in turn, more accumulation of dry matter as expressed by haulm yield.

5.2.10. Harvest index:

The harvest index is indicative of the efficiency of the treatment. If the harvest index is high it means the productivity level is also high. Thus, the treatment having higher harvest index is said to be more efficient. The harvest index was significantly influenced due to various water regime in the year 1986, but in the 2nd and 3rd year (1987, 1988) of the experimentation, the harvest index was not found effective by different irrigation treatments. However, during the year 1986 and 1987, the harvest index was recorded more under 0.8 IW/CPE schedule of irrigation which was at par with treatments having wider gap of irrigation (0.6 IW/CPE and maintained its superiority to rest
of the irrigation treatments. Under moisture stress or excess conditions, it had lower values. This may be attributed to less supply of water at pod filling stage hampering the proper grain filling, or the continuous supply of excess moisture till maturity (1.0 IW/CPE) resulted in vigorous vegetative growth resulting in poor partitioning of photosynthate towards grain.

Application of 60 kg \(P_2O_5/ha\) had higher harvest index during the year 1986 and 1988, but in the year 1987 it was recorded maximum with 20 kg \(P_2O_5/ha\). However, harvest index values under the effect of P levels were at par during all the three years.

5.3. **Oil character**:

5.3.1. & 2. **Oil content (%) and oil yield (q/ha)**:

The oil content is dependent on temperature during the first 3 weeks of pod developments, maturity of the kernels, which is influenced by rainfall distribution during the pod development stage and sulphur content in the pod zone. Oil accumulation is temperature sensitive, high-temperature favours high oil content (Smartt, 1976).

Highest oil content was found during all the years under study, in 0.8 IW/CPE schedule. The results are in conformity of the findings of Lenka and Mishra (1973), Kumthekar (1974) and Joshi (1978).
Similar to many other yield attributing characters, 60 kg P<sub>2</sub>O<sub>5</sub>/ha was able to give significant increase in oil percentage of the kernels. Kumar and Venkatachary (1971) also observed increase in oil content due to application of P. Application of P, in general, improved oil and protein contents (Reddi, 1988).

Oil yield quintal per hectare is the function of oil percentage in kernel and kernel yield per hectare. More oil yield under 0.8 IW/CPE schedule and 60 kg P<sub>2</sub>O<sub>5</sub>/ha is the result of more oil percentage and relatively higher kernel yields in corresponding treatments of irrigation schedule and phosphorus levels.

5.4. Uptake of nutrients:

5.4.1. N.P.K. content and uptake in kernels and stover:

5.4.1.1. Nitrogen (N):

Nitrogen requirement of groundnut crop is much higher than cereals. Nitrogen is known to be required in three major aspect of yield determination: (i) formation of vegetative structures for nutrient absorption land photosynthesis, (ii) formation of reproductive structures and determination of sink strength and, (iii) the production of assimilates to fill the economically sink. To meet this requirement continuous supply of nitrogen throughout the crop life must be ascertained.
At initial stages, an application of 20 kg Nitrogen basaly through fertilizer suffices this need. For further continuance, it is essential that by way of proper nodulation plant must fix sufficient atmospheric nitrogen. Reddy et al. (1983) assessed the role of moisture in the soil for nodulation, nitrogen fixation and, in turn, nitrogen content in the plants. As the total uptake of nitrogen is the product of nitrogen content (%) and yield of kernels and haulm, higher values for these will result for more uptake of the nutrient.

0.8 IW/CPE schedule seems to make continuous optimum supply of moisture, resulting in better uptake of nitrogen initially and by way of release of fixed nitrogen during later stages. Pankhurst and Sprent (1976) and Minchin and Pate (1975) also reported that nodulation, nitrogen fixation and nitrogen partitioning depends on available moisture, because low water potential in nodules reduces the nitrogen fixing ability directly and also the transport of fixed N out of nodules because of impaired supply of photosynthates from a stressed shoot system (Haung et al. 1975). Highest uptake of nitrogen in kernels and stovers was found with 60 kg P$_2$O$_5$/ha. This may be due to more availability and uptake of phosphorus synergised with more uptake and assimilation of nitrogen, forming the increased sink for the assimilate.
5.4.1.2. Phosphorus:

Much of phosphorus found in the plant is in the inorganic forms and it plays many roles in cell metabolism (Anonymous 1953). Terry and Ulrich (1973) reported that the deficiency of phosphorus would have a wide range of effects on cell functions.

0.8 IW/CPE was found to have highest uptake value of P in kernels as well as in Stover. This may be attributed to the positive effects of moisture. Also 60 kg $P_2O_5$/ha registered highest uptake of phosphorus in both kernels as well as stover. This may be due to the highest yield values of kernels and haulm having higher P content (%) too.

5.4.1.3. Potassium:

Potassium is essential for photosynthesis and pod development in groundnut. Potassium content in the plants seems to be associated with sulphur, phosphorus and calcium. Deficiency of these three elements was found to decrease significantly the potassium concentration in the plant parts (Anderson, 1971; Hall, 1975).

In present study higher concentration of K in 0.8 IW/CPE irrigation schedule and 60 kg $P_2O_5$/ha level of phosphorus may be interpreted on the above ground.
5.5. Water Relations:

5.5.1 & 2 Water application, water use & water use efficiency:

In the four irrigation treatments, the total irrigation water applied was 75, 65, 50 and 60 cm in the treatment 1.0, 0.8, 0.6 and 0.6 + 0.8 IW/CPE ratio respectively. For this amount of water applied, the water use or the consumptive use varied differently during different years of study. But on an average the water use or consumptive use of groundnut varied from 69.2 cm in IW/CPE ratio of 1.0 to 44.4 cm in the lowest IW/CPE ratio of 0.6. Thus it is evident from the study that under Raipur condition the water requirement for groundnut crop is about 69 cm without any water stress conditions.

However, it is well known that the water requirement of any crop would be less in the initial stages of crop growth and it becomes the highest during peak vegetative and reproductive stages. In view of this, a treatment with 0.6 IW/CPE upto peg formation stage and thereafter 0.8 IW/CPE ratio was taken. Under this treatment, the total water requirement was 52.6 cm with an highest water use efficiency next to IW/CPE ratio 1.0.

As regard to the W.U.E., the highest value was observed in case of 0.6 IW/CPE (53.51 kg pod/ha/cm of water) and this was followed by 0.8 IW/CPE ratio. But the water use
efficiency with 0.8 IW/CPE ratio was closely followed by 0.6 + 0.8 IW/CPE ratio. When the pod yields were compared, highest pod yield was observed in 0.8 IW/CPE ratio followed by 0.6 IW/CPE ratio. Thus, with a decrease of 2 q/ha pod yield an amount of 150 mm of irrigation water can be saved. But this gives the highest W.U.E. However, Ravi Kumar et al. (1985) reported that maintaining IW/CPE ratio of 0.8 throughout the crop period resulted in reduced pod yield as compared to IW/CPE ratio 0.65 up to pegging followed by 0.9 from pegging to pod formation and 0.8 thereafter. It may be the due to the fact that their observations were during the rabi season in which the pod formation stage occurs beginning of the summer season with increased water requirement, but in the present condition except the seedling stage the rest of the crop growth season comes under summer period. Hence higher amount of irrigation water found to be better than changing irrigation treatment in different crop growth season.

5.5.3. Effect of phosphorus levels on W.U.E. :

As it is shown in table 34 the pod yield in general, increased with increased levels of phosphorus. However, highest W.U.E. of 55.8 kg of pod/ha/cm of water was observed when averaged for all the irrigation treatments. An overall highest W.U.E. of 62.7 kg of pods/ha/cm was observed in IW/CPE ratio of 0.8 with a phosphorus dose of 40 kg/ha.
Thus when the irrigation and phosphorus treatments are combined, it can be recommended that under Raipur condition for summer groundnut crop irrigation application at IW/CPE ratio 0.8 with a phosphorus dose of 40 kg/ha is the best from pod yield as well as highest W.U.E. points of views.

Sinde and Pawar (1982) observed that the optimum irrigation quantity for groundnut would be 1100 mm with resultant yield of 30.5 quintal of pod/ha. However, in our present study the optimum water application of 650 mm was found with a resultant pod yield of 25.5 q/ha. Thus, though the pod yield were comparatively lesser under Raipur condition as compared to Jaikwadi and Purna command areas of Maharastra, the total water application requirement is about 59% of the same in that area.

5.6. Per hectare input cost and return:

As regard the input cost, variations were due to different number of irrigations in various irrigation schedule based on IW/CPE ratio and levels of phosphorus. More the number of irrigations higher the rate of phosphorus application more will be the input cost for respective treatment. Thus highest input cost was recorded with 1.0 IW/CPE having maximum number of irrigation followed by 0.6 + 0.8, 0.8 and 0.6 IW/CPE. Similarly 60 kg P₂O₅/ha resulted in
maximum input cost followed by 40, 20 and 0 kg $\text{P}_2\text{O}_5$/ha. Since the variations in yield did not follow the input cost trend, variation in net profit were recorded of different order.

Though 0.8 IW/CPE irrigation schedule was third in the order of input cost among the different water regimes, yield levels were recorded highest with this treatment leading to highest net profit (Rs. 9869/ha) and cost benefit ratio 1.54.

Regarding different levels of phosphorus input cost trend followed thereby resulting yield trend. This was the reason attributing the treatment of highest level of phosphorus (60 kg $\text{P}_2\text{O}_5$/ha) maximum net return (Rs. 10082) and cost benefit ratio (1.51).