CHAPTER 6

SUMMARY AND CONCLUSIONS
6. SUMMARY

The experiment entitled "Effect of light, moisture and nutrient in relation to methods of seeding and weed management on the productivity of direct seeded rice" was carried out at Agricultural Research Station, College of Agriculture, Indira Gandhi Krishi Vishwa Vidyalaya, Raipur, M.P. during the kharif seasons of 1985-86 and 1986-87 to study the crop-weed competition in direct sown rice. The aim of the study was also to evaluate the effective weed control practice under different methods of rice cultivation along with their economic feasibilities. The experiment was laid out in split plot design with three methods of sowing as main plot treatment, namely broadcasting ($M_1$), drilling by Datari seed drill 20 cm, apart the rows ($M_2$) and line sowing in 20 cm rows behind plough furrow ($M_3$). Similarly four weed management practices viz; butachlor pre-emergence 2 kg/ha ($W_1$), butachlor pre-em. 1 kg/ha plus one weeding at 30 DAS ($W_2$), Two weedings at 30 and 50 DAS ($W_3$) and unweeded check ($W_4$) were taken as subplot treatments with four replications. An early duration dwarf rice cultivar IR 36 was tried under direct sown condition in medium fertile clay loam soil, neutral in reaction with a uniform dose of fertilizers (60 kg N, 40 kg P$_2$O$_5$ and 20 kg K$_2$O/ha).

The distribution of weed species studied in direct sown rice showed little effect by seeding methods as was exhibited by almost similar percent distribution under different methods of cultivation. Both monocot and dicot weeds were present in
the experimental plots. Among the monocots, the most dominant species infesting the rice crop was *Echinochloa spp.* which contributed about 40 percent. The dicot weeds contributed only about 12 percent to the total distribution. The efficiency of different weed management practices were evaluated and it was observed that all weed control treatments recorded less number of weeds and produced lower dry matter as compared to no weeding treatment. As regards the chemical control through butachlor, it was very effective on grassy weeds and showed poor performance against sedges and forbs. Cultural method through manual weeding twice at 30 and 50 DAS recorded maximum weed control efficiency due to lower weed biomass. The rice biomass at tillering and vegetative stage exhibited the trend broadcasting > drilling > line sowing in both the years. At flowering stage broadcasting and drilling produced similar amount of biomass and at crop maturity drilling and line sowing recorded maximum biomass. In case of the net primary productivity (NPP) recorded for the biomass with respect to seeding methods, the maximum NPP were recorded at 100 DAS. The broadcast seeding method produced the highest NPP value while amongst weed control treatments unweeded check showed maximum NPP value at all the stages.

The total effect of the competition as reflected in the crop growth and yield results from competition for nutrient, moisture and sunlight. The radiation penetration decreases from top of the canopy to the bottom of the canopy during all the hours of the day and at all the crop growth stages. Radiation
penetration was more under line sowing followed by drilling and least in broadcasting till peak vegetative stage at mid canopy level. At flowering, penetration of radiation in to the crop canopy under line sowing method was less due to luxuriant crop growth. The radiation at noon hours was higher than the morning and evening hours. Unlike sowing methods, the effect of weeding in increased radiation penetration to the mid and bottom canopy. A clear cut distinction of low radiation penetration was observed in untreated plot as compared to weed control treated plot till vegetative stage and after that radiation penetration to the bottom of canopy increased. The radiation penetration at the middle and bottom of the canopies was higher in case of two hand weedings as compared to other treatments. Hours of observation in respect of herbicide treatments too, more trend radiation penetration in morning hours than in the evening hours.

Soil water suction under various treatments and seasons fluctuated between 0 to 90 cm of water and this value of suction is not of high magnitude. Soil moisture suction was the highest in cultural weed management and no weeding treatment due to higher crop biomass and due to higher weed biomass production respectively. Soil moisture suction at 110 DAS was double in 1986 to that of the season in 1985.

Nutrient concentration in rice plant and weeds was not much influenced under any of the seeding methods as well as weed control treatments. The total uptake (grain and straw) of N, P and K by crop was significantly lower in untreated plot than all
other weed control treatments. The uptake of NPK by the crop was higher in drilling method as compared to broadcast seeding and at par with line sowing. Amongst weed control treatments, the maximum uptake of NPK was recorded in two hand weeding. The total uptake nutrients of weed in unweeded plot was less than the uptake of nutrients by the crop alone in weeding treatment. Broadcast seeding method had more uptake of NPK as compared to other seeding methods. No weeding treatment showed maximum uptake of nutrients and minimum under two weeding treatment.

The seeding methods did not influenced much the height of the rice plants and total number of days required for maturity after sowing by test crop. Maximum height of rice plant was recorded under two weedings. Maximum tiller development was seen under broadcast seeding method and on the other hand produced higher number of non-earbearing tillers also. Hand weeding given twice produced significantly higher number of panicles/m² over other weed control treatment. Panicle weight was significantly affected under method of cultivation and weed management practice. The maximum panicle weight was recorded under line sowing and drilling method and amongst weed control treatments two weeding attained maximum panicle weight at par with chemical treatment. The sound and unsound spikelets/panicle were also significantly affected due to various treatments. The spikelet per panicle was considerably higher in drilling and line sowing methods. The maximum number of grain/panicle was recorded under cultural weed management system followed by herbicide treatment. The highest spikelet sterility was observed with
broadcast seeding under no weed control treatment and minimum with two hand weeding in drilled crop. The test weight of grain was also significantly affected under different treatments. Highest test weight was recorded under line sowing and drilling method as compared to broadcast seeding. Maximum grain test weight was seen with two weeding and the minimum with no weed control treatment.

Rice grain and straw yields were significantly affected due to various treatments and the maximum grain yield was obtained under drilling method of sowing. Broadcast seeding recorded significantly lower grain yield over drilling and line sowing methods. Among the four weed control treatments cultural weed management system \((W_3)\) was found most effective measure against weeds and produced highest yield and was at par with butachlor \((W_4)\). Unweeded check \((W_4)\) produced 80, 80 and 82 percent lower grain yield over \(W_1, W_2\) and 
\(W_3\) treatments respectively. The grain yield reduction was minimum under herbicide treated plots and maximum reduction observed with unweeded check. Harvest index differed significantly under weed control treatments while seeding methods were found insignificant. There was negative correlation of rice yield with weed biomass and spikelet sterility while positive correlation was noted with panicle number and panicle weight. Among the four weed control treatments, the highest net return/unit investment was found in the line sowing and drilling with two hand weeding. In broadcast sowing highest net return per unit investment was found to be in respect with herbicide application.
Conclusions and recommendations from the findings:

Major area under rice in Madhya Pradesh specially the south-eastern part known as 'Chhattisgarh region' is occupied by rainfed rice where yields are extremely low mainly due to poor crop stand and severe weed competition. The entire cultivation is dependent on monsoon which is uncertain, ill-distributed and unpredictable. The farmers grow rice under these conditions by direct sowing as well as by transplanting in very limited area. Under direct sowing, seeding through broadcast in dry as well as moist soil is practised, which results in uneven crop stand. The worst aspect of such rice crop is the mixed stand in which it is difficult to distinguish easily between the rice and the weeds. Poor germination of seeds in dry seeding results on account of non-maintenance of moisture in the top 5-6 cm soil and in the moist seeding because of sudden flooding and result in compaction of the top soil after heavy showers.

In order to ensure a better crop stand, rice seeds must be sown in such a manner that it remain in the moist soil as long as the seedling emerge out of the soil and are also in a position where it may be possible to distinguish these seedlings from the weeds. Sowing of the rice seeds in lines 20-30 cm apart at a depth of 5 cm has been found helpful in achieving these objectives.

However, it may be recommended that for better uniform germination and optimum crop stand rice seeds should be sown by seed drill in lines.
A point has already been made that rainfed rice is grown under conditions conducive to profuse weed growth. As such, during the early stages of growth of rice, severe rice weed competition for light, moisture, space and nutrients are easily obtained. However, if the weed population could effectively be controlled, direct seeded rainfed rice cultivation may offer an unique advantage of raising yields at par with irrigated rice. But this task again is not easy. The type of the weed flora obtainable under rainfed conditions is so variable that it may not be possible to control them by one method alone. Not only this, flushes of weeds come up at different stages. The experimental results show clearly that the losses caused by weeds can be reduced to a great length by chemical as well as cultural methods. Keeping the rice fields weed free is by far, the best method for minimising the losses due to weeds. But this will not be possible in view of the labour cost. The second alternative appears to be an application of chemical herbicides.

With the rapid industrialization and consequent migration of labour force to urban areas in search to better paid industrial jobs and increased literacy in the younger generation, there is a growing acute labour shortage for farm operations in the village. Further more, the increase in labour wages has been much higher than the increase in price of farm produce, thus eroding the profitability of farming. In case where herbicides are more expensive, the increase in yield, i.e., comparison to that obtained by manual and mechanical methods, more than compensated for the increased cost of weed control.