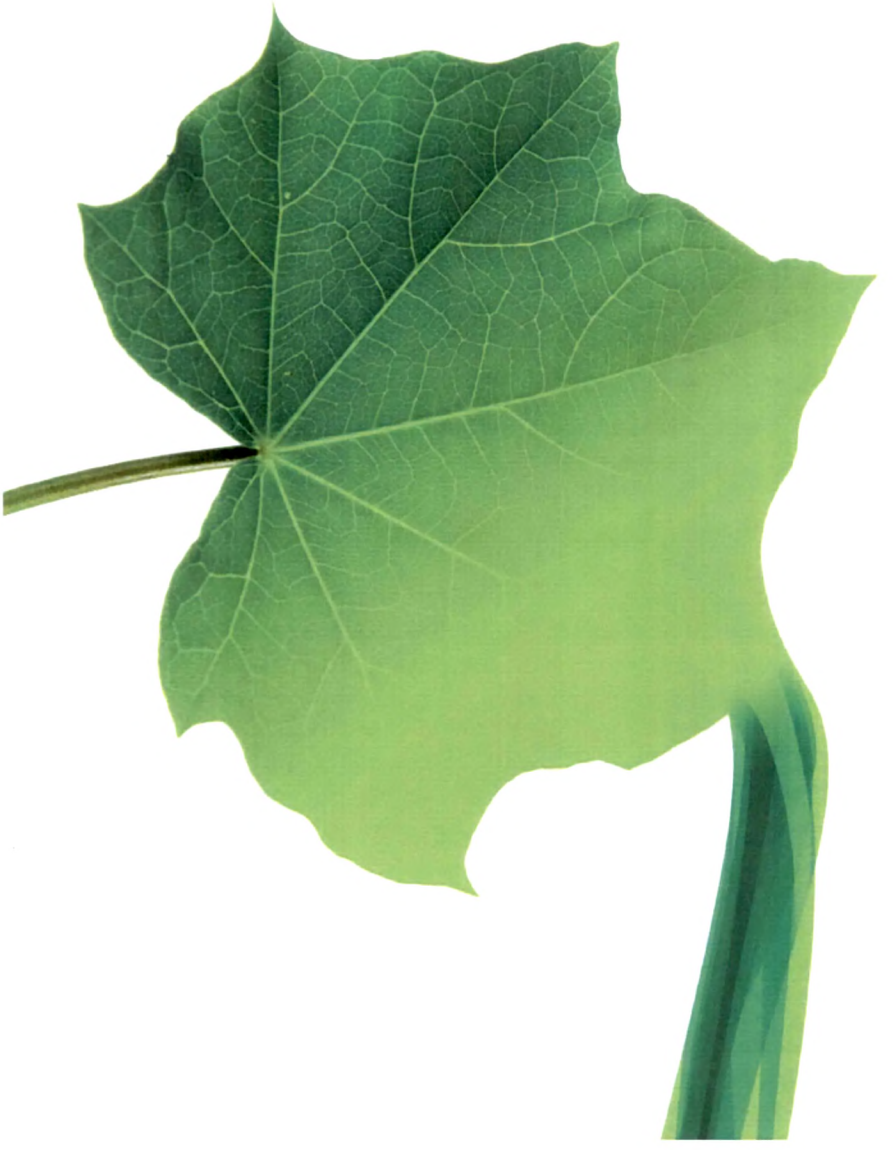
Summary & Conclusion



Identifying an alternative fuel source has become imperative. *Jatropha curcas* has all the properties to enable it to be considered as a promising alternative fuel source. Systematic scientific studies will help to understand the plant better. This will also help to device ways to increase its innate potential. In this study, *Jatropha curcas* plantations from different regions of Gujarat were studied with aim to identify any variations in the crop with respect to its flower yield, sex ratio, fruit and seed yield, oil content and fatty acid profile of the oil. The plantations from regions such as Bodal, Degama, Navsari, Himmatnagar, Kawant, Umeta, Vadodara and Padra were used for this study. Plantation from Vadodara region showed significantly high fruit and oil yield compared to other regions. The total number of flowers observed in this plantation was also higher. There was not much significant difference in most other parameters observed. The oil content on an average was between 35 to 45 g % from all regions. This was an ideal yield when compared to existing reports. To make the per hectare yield more economically viable it is beneficial to increase yield per plant. Phytohormones are one option that could be used to achieve this. GA, Ethylene and Auxins are phytohormones used most frequently to increase yield in plants. In this study, they were used at varying concentration from the onset of flowering. Spraying plants with exogenous GA, Ethrel, Auxin showed they could increase femaleness in Jatropha plants in a concentration dependent manner. Of all the treatments, GA (1000 ppm) shows highest flowering and femaleness. The increase in femaleness did not translate into high fruit yield for GA and Ethylene treated plants for various reasons. GA increased length of peduncle making it weaker because of which withering of flowers before pollination under the influence of hydrogen peroxide at the abscission zone was seen. 2, 4-D was capable of increasing flowering and sex ratio without any ill effects of withering as seen in GA. It was also capable of reversing the withering seen in GA (1000 ppm). Apart from increasing femaleness, GA enhanced inflorescence and fruit development.

The flowering time genes and floral meristem identity genes play a major role during flowering in plant. GA induces the floral meristem identity genes such as *LFY, API* and *SOC1.* In this study hence, exogenous GA treatment could increase endogenous level of GA resulting in increased femaleness. There is a known cross talk between GA and Ethylene. Though ethylene is known to increase femaleness at higher concentration, an opposite effect is seen. Ethylene at higher concentrations can increase the activity of

cellulolytic enzymes by increasing the release of hydrogen peroxide. The withering seen with GA 1000 ppm treatment could also be because of enhanced ethylene synthesis as it has been reported that GA increases endogenous ethylene levels at higher concentration. Silver thiosulfate, was used in this study as an inhibitor of ethylene. However, the deleterious effects of ethylene or GA at higher dose on femaleness could not be negated by it. The endogenous levels of GA, IAA, ethylene and its precursor ACC were determined in response to various exogenous treatments with phytohormones. Overall, it was observed that high endogenous GA and ethylene, low IAA promotes femaleness. It was also observed that high endogenous GA but decrease in ethylene level improves the fruit yield. Silver thiosulfate decreases the endogenous GA, IAA and ethylene, which decreases flowering, femaleness and fruit yield.

GA and Ethrel at higher concentration showed abscission of flowers. The biochemical mechanism involved in abscission was studied. The results show that, there is decrease in Catalase and increasthe in SOD and Peroxidase activity in the abscission zone leading to withering. Mechanisms which lead to Cell death was observed. Staining cells with DAPI and observing under fluorescence microscope revealed that higher dose of GA shows necrotic type of cell death, as it leads to DNA fragmentation and complete damage of nucleus. Silver thiosulfate and higher dose of ethylene also causes cell death. Lower dose of GA protects the tissue from the harmful effect of Silver thosulfate during abscission process.

In conclusion, phytohormone treatment can be used to increase the yield of Jatropha curcas. Of all the phytohormones, GA treatment of *Jatropha curcas* foliar bud increases the number of female flowers and hastens flower development due to increased endogenous level of GA. 2, 4-D treatment on *Jatropha curcas* foliar bud also increases the number of female flowers and fruit yield. Higher dose of Ethrel treatment decreases the number of flowers and delays the flower development due to decreased endogenous level of Auxin. Higher number of female flowers at 1000 ppm of GA did not translate into high fruit yield due to withering of immature fruits and flowers. Withering of fruits and flowers could be due to greater peduncle length and cell death mediated by hydrogen peroxide release at the zone of abscission. Using inhibitors to decrease peduncle length

may help in capitalizing on the increase number of female flowers. 2, 4-D at higher concentration increases the number of flowers and fruit yield. Applying the results of such studies to field could help to increase the potential of *Jatropha curcas* as a bio-fuel crop. It would be a huge leap in per hectare production of Jatropha ensuring its commercial success. *Jatropha curcas* then can truly be an apt source of biodiesel.