In terms of volume, jute is the important natural fibre, next only to cotton. India and Bangladesh produce the bulk of jute fibre of the world. In India, jute is cultivated mainly in the eastern states like West Bengal, Assam, Tripura, Bihar, Orissa and to some extent in Uttar Pradesh where the amount and pattern of rainfall during the summer for successful cultivation of jute for fibre, is adequate and assured. In India and Bangladesh, jute is annually cultivated in about 0.83 and 0.53 millions of hectares respectively and these two countries produce jute fibre more than four fifths of the international trade. Both these countries earn substantial amounts of foreign exchange by exporting raw jute fibre and finished goods of jute. Thus jute plays a vital role in the economy of these two developing countries.

Jute, a bast fibre, is obtained from the bark of the stem of the plants of Corchorus olitorius L. and Corchorus capsularis L. The former species is grown in high land as it is unable to withstand prolonged waterlogging during its active growth phase and the latter species is normally raised in low land since it is able to withstand waterlogging. The differences in adaptability of the two species are indicative of their physiological differentiation that took place in the course of evolution. Growth of the stem of jute plant takes place by the activity of the apical meristem responsible for elongation of stem. The fibre in jute stem originates by the activity of the secondary cambium which divides to form the phloem tissue peripherally and woody tissues inside. Fibre initials are cut
off by the cambium cells and grow longitudinally along the stem axis and aggregate into fibre strands interspersed by thin walled phloem parenchyma. The production and the development of fibre are directly related with the vegetative growth of stem. This is why the fibre yield is proportional to the height of main stem of the jute plant. In view of this sort of developmental phenomenon in jute, selection for high fibre yield is done on the basis of tallness of the plant.

The history of commercial jute cultivation is hardly a century old. With the increasing demand of jute fibre selection for high yielding jute plant naturally led to identifying tall types. The wild types of both the species of jute from which selection for high yield was initiated, were of short stature, early flowering and highly branching. Early termination of vegetative phase and extension of reproductive phase for longer period through successive production of fruit bearing branches are biological necessities of wild forms for their survival. Such a pattern of growth and development ensures the wild forms to produce as large as possible a number of seeds in a generation to attain a high level of fitness in genetical term. Because of the shorter height of the main stem and of the presence of well developed lateral branches, these wild forms did not serve the purpose of obtaining a high yield nor did it give a single untangled reed which was commercially convenient to handle and convenient for the mill as well. Thus while selecting for a high yielding jute type from wild ones, major emphasis was laid
on late flowering which allowed a longer vegetative growth, producing taller plant with more number of leaves on the main stem as well as which effectively supressed lateral branch formation due to prolonged prevalence of apical dominance. Obviously the evolution of present cultivated form from the wild ones was possible through gradual substitution of genes responsible for late flowering, tallness, delayed withdrawal of apical dominance and more number of leaves on main stem. However, it will be erroneous to assume that changes of the above mentioned characters alone were responsible for the improvement of yield. For sustenance of increased physiological activities inherent in cultivated types, the efficiencies of nutrient uptake anchorage and interception of solar radiation through genetic modification of root system and leaf characteristics must have been concomitantly increased unguided by the breeders.

Jute being a high density crop (60 to 80 plants per square meter) must have prompted breeders, though unconsciously, to select jute plants with narrow leaf angle to reduce mutual shading of leaves to the minimum.

Studies on genetic investigation have indicated that fibre yield components such as plant height, base diameter, node number (i.e. number of leaves on the main stem) and days to flower in improved types were under polygenic control (Basak, Jana and Paria, 1974). It is evident that during the course of evolution of improved types from wild ones, substitution and assemblage of favourable polygenes controlling these characters took place. Presumably such a genetic transformation of jute
plant type accompanied changes in the pattern of growth and development due to altered physiology. But comprehensive and critical studies on the physiology of productivity of jute are limited (Kar and De Sarkar, 1954; Kar, 1959; Gopalkrishnan, 1979). Gopalkrishnan and Goswami (1970) were first to find out in *C. olitorius* considerable varietal difference in leaf area indices at early and peak period of growth. Palit and Bhattacharya (1982) taking two high yielding varieties each of the two species, *C. olitorius* and *C. capsularis*, carried out physiological analysis of growth and fibre productivity in them. They found significant difference between the two species regarding the source activity (Net Assimilation Rate, NAR) but did not find any difference in harvest index among the cultivars. These studies were not sufficient to locate genotypic difference within a species of jute regarding dry matter accumulation, net assimilation rate, leaf area and other growth parameters. A host of studies in recent time in other crops do suggest the existence of genetic control for physiological and morphological traits related to biological and economic yield (Wallace, Ozburn and Munger, 1972; Wilson, 1981). The existence of genetic control for any character gets confirmed from the response to selection. The evidences available for response to selection for different physiological traits related to biological and economic yield are quite encouraging. High yielding rice and wheat provide examples of the merit of selecting physiological components, governing yield. In soybean populations derived from diverse
genetic backgrounds, Ojima (1972) found it possible to select single F_2 plants higher in leaf photosynthetic rate than high parent and to maintain higher rates in the F_3 lines. Moss and Musgrave (1971) cited an example of a success of selection for photosynthetic rates in maize leaf; selection was initiated from four inbred lines and by five generations 6 high and 3 low selections (for photosynthetic rates) from each of the four inbred lines could be established. This example of eliciting response to selection from so called inbred lines of corn indicates that these inbred had sufficient residual genetic variability within them. Secor et al. (1982) were able to select high and low photosynthesizing lines from F_7 generation of a cross between two soybean varieties differing in photosynthetic capacity and the high and the low lines maintained their difference regarding this trait in F_8 generation. Rhodes (1975) executed intracultivar selection in rye grass for canopy characters and associated dry matter yield for four generation and was successful in obtaining appreciable response to selection for these characters. Crosbie et al. (1981) conducted five cycles recurrent phenotypic selection for CO_2-exchange rate (CER) in two maize populations and three cycles for low CER in one population. Their data demonstrated that selection for CER for five cycles resulted in significant improvement in two high CER population. In contrast, the selection advance for low CER population was considerably smaller than those in high population. The success in improving photosynthetic rate in maize through recurrent selection is indeed the most convincing evidence of genetic control for
photosynthesis. These experimental examples eminently provide evidences for genetic control of physiological components and prompt the breeder of other crops to become optimistic about the scope of genetic manipulation and selection of physiological traits related to biological and economic yield. Keeping in view the genetic changes that led evolution of the present cultivated forms of jute and the above mentioned examples, geneticists concerned with this crop can expect to improve physiological components of yield, provided the nature of inheritance of these components or traits is fairly understood.

Fibre yield of jute is almost entirely dependent on the vegetative growth and unlike crops where economic yield is obtained from reproductive parts, the major part of the sink lies in the stem which is composed of an woody core and the bark around it. From the bark jute fibre of commerce in the form of lignocellulose is derived. Hence it is obvious that the economic yield of jute is produced through a complex physiological event. The economic yield is not even one fourth of the total biological yield expressed in dry weight and accordingly out of 15 tonnes of total dry weight per hectare, only 30 quintals of dry fibre is obtained. But 15 tonnes of dry matter per hectare would produce 60 quintals of economic yield of wheat, if a conservative harvest index of 40% is assumed, taking an average of 49% of harvest index in current high yielding dwarf wheat (Thorne et al., 1969) and of 32% of harvest index in wheat of early 1900's (Van Dobben, 1962). This account emphasises the need for evolving a jute type that would be more efficient
in partitioning the photosynthate in favour of fibre production as has been done for grain yield in wheat or rice. From the fact that jute produces a high amount of biomass (10 to 15 tonnes of dry matter per hectare) per unit area, it is evident that modern varieties of jute species is photosynthetically quite active. If one assumes taking clues from the experimental evidences from other crops that biological and economic yield of jute are under genetic control, then logically one would expect that genetic manipulation of associated physiological traits would lead to increase economic yield and thus increase the harvest index. But before attempting to do so the basic knowledge on the nature of genetic control for harvest index, net assimilation rate, leaf area index, relative growth rate, net CO₂ exchange, dark photorespiration and light interception of jute has to be known along their magnitude of variation due to environmental changes, for formulating a sound breeding strategy to improve harvest index.

With this aim in view investigation was undertaken to elucidate the nature of inheritance of dry matter production, RGR, NAR, LAI, leaf angle, harvest index and fibre yield in two contrasting sets of diallel crosses, one consisting of high yielding varieties and other consisting of wild types of *Corchorus olitorius* with an additional interest to understand the inherent difference between the wild and cultivated types as regards the physiological components mentioned above.