INTRODUCTION

Chapter - I

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Soybean (Glycine max.) is visualised as food grain of high potential to meet the part of protein and fat requirements of Indian masses, particularly rural and urban poor, children, pregnant women and lactating mothers. However, the production potential of pulses including soybean is sufficiently low in comparison with cereals. The global annual production of soybean in 1985 - 86 was 94.12 million tonnes in which India contributed 1.1 million tonnes (1.16%) only (Soybean Blue Book, 1985-86). Assuming the average daily consumption of 15 g/day (6 g/day protein) against the total requirement of 87.5 g/day of soybean, the country needs to produce about 4 million tonnes of soybean for the present population. While for fulfilling the average requirement of protein (35 g/day) through soybean alone, the annual production should reach about 25 million tonnes. This abrupt rise in production, thus, becomes a challenging and herculean task to accomplish. Though the pulses are very important dietary constituent in India, the ratio of legume to cereal has gone down from 0.17 in 1951-52 to 0.10 in 1979-80 (Pushpamma and Chittemma, 1981) and per capita consumption of pulses has also declined from 61 in 1951 to 38 g/day in 1981 against the minimum requirement of 85 g/day per capita. The high demand of protein coupled with limited possibility of enhancing the productivity of pulses has ever widened the gap between supply and demand of protein with consequent hike in prices of pulses in the country. The stagnant production of pulses (about 11 million tonnes), high cost of animal protein and increasing demand of protein requirement due to current population growth rightly evoke the consensus in agricultural engineers and scientists for increasing the production and productivity of soybean through judicious harvest and post harvest operations.

Soybean being rich source of protein (40%) and oil (20%) can be an appropriate substitute to other pulses because unit increase in productivity of soybean is equivalent to about two units increase in productivity of other pulses containing about 20% protein. In addition, the soybean has wide range of adaptability with geographical locations, soils and allied weather conditions and can very well supplement the common cereal-based diet of this country with essential proteins, where animal protein is scarce and its consumption is limited because of socio-economic reasons. The current call to increasing production and productivity of protein through extensive soybean cultivation is, therefore, justifiable and desirable proposition for this country.

The production and productivity of soybean can be elevated by introducing the preharvest and post-harvest improved management technologies. Alongwith increasing the soybean productivity and production now and in near future, management aspect of saving grain needs immediate attention keeping in view the high value and susceptibility of the crop to shattering and other kind of losses during harvest and post harvest operations.

The soybean plant is of bushy nature with a hard and thick stem. It bears pods on main stem very close to the soil surface also. After attaining the physiological maturity, the plant dries up in a short span of time resulting in increase in possibility of shattering of grain and pods in field and damage of grain during harvesting, transport and threshing. Norman (1967) reported that the soybean grain contained 65 per cent moisture at maturity and the moisture content abruptly declined to 10 to 15 per cent within a period of 1 to 2 weeks just prior to harvest. The survey by

Quick (1972) showed that losses did not decline below 9 per cent of the total yield since the last four and half decades. The soybean crop being highly susceptible to shattering losses, spoilage of grain in pods due to occasional rains received during the harvesting period and losses due to impact damage require more careful handling during harvesting and threshing operations to avoid stress cracks, splits and breakage of kernels. Broken soybean grains loose their value as seed and create storage problems because of accelerated attack on the exposed oily and proteinous materials. The harvesting of soybean crop at proper time and suitable moisture content of grain becomes imperative to achieve higher and better quality grain yield.

The use of combines, reapers or reaper windrower's for harvesting soybean crop is not in vogue in the country because of crop's characteristics and also limited availability of these machines. Thus, Indian farmers resort to harvesting the crop manually. Generally hand tool (sickles) for harvesting and bullocks or tractor treading for threshing are practised. Threshers available in India mostly have peg tooth type of threshing cylinders and are used extensively for wheat crop threshing. Whereas the soybean crop is generally harvested and threshed by combines using rasp bar type of cylinder and straw walkers in developed countries. In India, where the combining of soybean crop can not be practically feasible and economically viable practice in the soybean cultivation area , the threshers with rasp bar type cylinder were tried and developed with the presumption of separating the grain from soybean crop keeping the hard stems and branches intact. If the crop is harvested after attaining the physiological maturity at relatively higher moisture content, the foliage can be used as cattle feed. In addition, it is hypothesized that the threshers with rasp bar cylinders would consume less energy in comparison with threshers with peg type cylinders. With the hypothesis of making the existing peg type threshers suitable also for threshing the soybean, the crop and machine parameters were considered important to be optimised for peg type cylinders.

Keeping these points in view, the present study included field and laboratory experiments and designing and developing suitable threshing models to accomplish the following objectives:

i) to study the influence of grain and pod moisture content and harvesting stage on the yield and quality of grain,

ii) to optimise the crop and threshing cylinder parameters for improving the threshing effectiveness and grain quality of soybean at low energy consumption, and

iii) to evolve the relationship among crop and machine parameters for predicting the energy requirement to achieve effective threshing.