

## INTRODUCTION

Agriculture in India is unique in its characteristics, where over 250 different crops are cultivated in its varied agro-climatic regions, unlike 25 to 30 crops grown in many of the developed nations of the world. Moreover, the use of various sources of power from the humble arm of the farmer to the mightiest of tractors is ubiquitous. India is the largest producer of tractors in the world. The quantum of research outlay for the farming sector is a meagre 0.86 % of the GDP as against 2-3 % in the developed world. In spite of this disparity, India has emerged as a net exporter of food grains and continues to forge ahead in the adoption and indigenisation of many of the advanced technologies developed elsewhere in the world.

In 1951, when the country was in its formative years after centuries of colonial rule, there were only 8635 tractors in use and all of them were imported. Production of tractors commenced during 1961-62, turning out 880 of them. This figure has peaked to over 262,000 in 1999-2000. The sale of tractors in 2003-2004 was 172,000. The quantum of power available for the farming sector rose from 45.29 million kW in 1971-1972 to over 170 million kW in 2000-2001. Correspondingly, power intensity on the Indian farm increased from 0.2 kW/ha to 1.30 kW/ha on the basis of net-cropped area. The state of Punjab has the highest average farm-power intensity of 3.5 kW/ha and also has the highest productivity levels. During the same period, contribution of animate power reduced from 60% of the total farm power to less than 17% and mechanical and electrical power sources increased from 40% to over 83%. It is also seen that the adoption of mechanical and electrical power was higher for stationary applications than for traction required for field operations. Power for traction (tractors and power tillers) increased from 8.46% to 32.85%, indicating that more and more power-operated equipment were coming into use. Human power continues to be a significant component for digging, clod breaking, sowing, interculture, harvesting, threshing, cleaning, and grading for which traditional tools and implements have evolved over time in different parts of the country. The small and marginal farmers rely on draught animals for field operations, transport and agro-processing. The extent of area under the command of draught animals is about 57%.

The need to achieve timeliness of field operations and effective utilisation of inputs has resulted in the development of appropriate machinery, which also reduce drudgery. Traditional tools and implements such as bullock-operated country plough, and *bakhar* for tillage, *dufan* or *tifan*, *enatigoru* and funnel and tube-attachment on country ploughs as sowing devices; sickles, *khurpi*, spades and *olpad* thresher for harvesting, digging and threshing; and swing basket, Persian wheel (*rahat*) and cradle pump for irrigation, etc. have been very popular in India. Use of electric or diesel engine-operated irrigation pumps, animal and tractor-operated cultivator and disc harrow for seed-bed preparation; seed drill or seed-cum-fertilizer drill and planter for line sowing with fertilizer application; and mechanical power thresher and combine harvesters has also increased. Farmers have also adopted sprinkler-and drip-irrigation systems in commercial crops.

Sun drying, winnowing, paddy hulling, pulse milling, oil expelling, wheat milling, pickle making, *gur* and *khandsari*, *ghee* and *khoa* making etc. are the major processing activities undertaken by the farmers. The traditional processing equipment used by the farmers include *supa*, *chalni*, *chakiya*, *janta*, *silbatta*, *okhli*, *mathani*, puffing pan, mini oil *ghanis/kolhus*, rice hullers and flour *chakkis* etc. High capacity modern machines introduced in urban and suburban areas for processing of agricultural produce have helped in increasing the income of the processors.

Use of wind and solar energy for winnowing and drying have been in vogue from times immemorial. India receives about  $5 \times 10^{15}$  kWh/year solar energy, which can profitably be

utilised for over 200 days in a year. The availability of solar photovoltaic devices has encouraged their use for water pumping and lighting. Several designs of cookers and water heaters are also available. Cooking needs of the villages are mostly met by the burning of biomass. Anaerobic fermentation of animal excreta for the generation of methane has attained considerable attention and several designs of biogas plants are in use. Biomass can also be gasified to obtain a combustible gas mixture mainly consisting of carbon monoxide and hydrogen in specially designed apparatus. This gas can be utilised for thermal applications and also for running engines. Cellulose based waste and non-edible oils of plant origin can be converted by bio-chemical processes to alcohol and esters for use in internal combustion engines to provide motive power and reduce the dependence on fossil fuels.

The manufacture of agricultural machinery in the country is carried out by village artisans, tiny units, small-scale industries and the State Agro-Industrial Development Corporations. Production of tractors, motors, engines and process equipment is the domain of the organised sector. The traditional artisans and small-scale industries rely upon own experience; user's feedback and government owned research and development institutions for technological support and operate from their backyards or on road side establishments without regular utility services. Medium and large-scale industries operate in their own premises with sound infrastructure, usually forming a part of an industrial estate, well-established manufacturing and marketing facilities and employ skilled manpower. Diesel engines, electric motors, irrigation pumps, sprayers and dusters, land development machinery, tractors, spare parts, power tillers, post harvest and processing machinery and dairy equipment are produced in this sector. They have professional marketing network of dealers and provide effective after sales service. They also have in-house research and development facilities or have joint ventures with advanced countries for technology upgradation. India is recognized, the world over, as a leader in the manufacture of agricultural equipment and machinery such as combine harvesters, plant protection equipment, drip irrigation and micro-sprinkler. Sizeable quantities of farm implements are exported to Africa, Middle East, Asia, South America and other countries.

**Directory of Agricultural Machinery and Manufacturers** is an attempt to put together all relevant information regarding the availability of various implements for land development, seed bed preparation, seeding and planting, interculture, plant protection, irrigation, harvesting and threshing and post harvest operations. It also covers many of the renewable energy technologies available in the country for the use of the average farmer or the farming community. It provides information on various types of tools, implements and equipment used in production agriculture and processing. Information on each item contains a brief description of its construction, broad specifications, its uses and power source required. At the end of each item, its source of availability has been provided for ready reference. The list of manufacturers has been provided separately as an Appendix. In this appendix, a state wise list of manufacturers is also appended to facilitate easy location of local manufacturers. The information provided is quite exhaustive but by no means complete. Additions, alterations, suggestions and additional information may be provided by the users for issuing supplements and to incorporate them in future editions