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Use of Farm Implements Machinery to Enhance Productivity of Medicinal and Aromatic Plants

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I. INTRODUCTION

Plants have been one of the important sources of medicines ever since the dawn of human civilization. Out of nearly 300000 species of higher plants available, only a small portion has been investigated for medicinal properties, and a still small number yield well-defined drug. A very small proportion of Indian medicinal plants are lower plants like lichens ferns, algae etc. The majority of medicinal plants are higher plants. The major families in which medicinal plants occur are Fabaceae, Euphorbiaceae, Asteraceae, Poaceae, Rubiaceae, Cucurbitaceae, Apiaceae, Convolvulaceae, Malvaceae and Solanaceae. Drugs are derived from trees, shrubs and herbs and even from primitive kinds of plants, which do not fall into the above categories. They are made from fruits (Senna, Solanum Viarum, Datura etc.), flowers (Butea monosperma, Bauhinia Verigata), leaves (Senna, Datura, Periwinkle, Tylophora, etc.) stems (Liquorice, Ginger, Dioscorea, Costus, Garlic), roots (Rauvolfia, Periwinkle, Ginseng, etc.) seeds (Isabgol, Abrus, Nux vomica) and even bark (Cinohona).

The Aryance of Indus valley wrote three treatises, viz. the Rigveda (2000 BC), Atharvaveda (2000-1000 BC) and Ayurveda (100-600 BC) which mention several medicinal plants and their uses, including the hallucinogenic mushrooms Amanita, muscaria and Rauvolfia Serpentina used to treat snakebite, epilepsy, mental disorders and other illness.

There is a tremendous demand for raw materials from all four segments of the drug industry: (i) Plant drugs for Indian systems of medicines covering the Ayurvedic, Unani and Siddha systems, (ii) Over-the counter non-prescription items involving plants, extracts and Galanicals, (iii) Essential oils and (iv) Phytophamaceuticals. Some of the medicinal plants growing in the wild are becoming extinct on account of destructive collection techniques, particularly when the whole plant is uprooted. It is estimated that in 1980, the sales of herbal medicines in Europian community accounted for Rs.7000 crores (US $ 2.25 billions). This is only 3 per cent of the European pharma market estimated at Rs.211000 crores (US $ 66 billion). In the EC market for phytomedicines, Germany has the largest share at Rs.4800 crores (US $ 1.5 billion), i.e. 2.2 per cent of the total. The size of the French market for herbal medicine is Rs.670 crores (US $ 0.21 billion), which amounts to less than 1 per cent of the EC market. The UK market is Rs.1300 crores (US $ 425 million). The share of the Indian market is negligible, not withstanding the fact that we have a varied emoporium of medicinal plants and are the exporters of over 200 major drugs and pharmaceuticals. India has been a traditional exporter of medicinal plants for the past several decades and ranks as one of the foremost supplier of medicinal plants in the world. The annual export of vegetable drugs, from India has been on the increase and during the year 1995-96 it has gone upto Rs.189.30 crores, besides the fact that we have a varied emporium of medicinal plants and are the exporters of over 200 major drugs and pharmaceuticals. India has been a traditional exporter of medicinal plants for the past several decades and ranks as one of the foremost supplier of medicinal plants in the world. The annual export of vegetable drugs, from India has been on the increase and during the year 1995-96 it has gone up to Rs.189.30 crores, besides the expert of Rs.70.03 crores worth of alkaloids.

Mechanisation

The use of Farm Implements and Machinery is a package of technology to (i) ensure timeliness of field operation to increase productivity, reduce crop loss and improve the quality of agro-produce, (ii) increase land and other inputs productivity more effectively and (iii) increase labour productivity using labour saving and drugery reducing devices besides, being cost effective and eco-friendly. The major areas of mechanization of medicinal and aromatic plants are: (A) Production Operations and (B) Post Production Operations. The production operation includes use of machinery for nursery raising, field preparation and other associated field planting and transplanting. Weeding and inter culture, plant protection, irrigation, harvesting, miscellaneous needs and covered cultivation. The post production operations include use of machinery for cleaning, washing, grading and packaging, storage, transport system and value added products and technology. The scope and sue of implements and machinery in this sector is enormous and yet to be exploited.

Soil working hand tools

Use oh hand tools is predominant in hilly areas where the slopes are high and difficult even to make terraced fields. Hand tools are used in all the operations right from land preparation to the harvesting of the crop. These include pickaxe, kodali, powrah, digging pronged hoe, trench hoe, spades and seprangs, forks, hoepcumprake, mattock, furrow opener, shovel, hand shovel, hand rake, garden rake, hand leveler, crow bar, earth auger, dibbling stick, automatic dibbler, rotary dibbler, plant replacer, transplanting trowels,

Hand tools for cutting and propagation

Cutting tools like axe, dah, billhook etc are are used for cutting and delimbing and removal of unwanted plant growth. The propagation tools include knives, pruning tools and shears. These include axe, dah, billhook, budding knife, grafting knife, budding and grafting knife, pruning and slashing knives, pruning secateures, pneumatic secateures, tree pruner, pruning saw, hedge shear, lopping shear, forester sheargrass shear, garden sword and scissors.

Weeding and intercultural tools

Weeding and interculture are important operations in raising of aromatic and medicinal plants. The tools and implements for mechanical weed control are mostly manual and power operated. These include khurpi, weeding hook, straight blade hand hoe, V-blade hand hoe, dutch hoe, karjat hoe, three tined hand hoe, wheel hoe, hand cultivator, hand hoe, star weeder, star weeder, peg type weeder, push-pull weeder, draw weeder and power weeder.

Plant protection equipment

The crops are highly affected by pests and diseases. Various methods are employed to control the incidence of insect, pest and diseases attack of which the preventive control has received the greatest attention of the environmentalists which include the protection of the host, cultural control, ecological control, biological control, autocidal method, physical and mechanical methods, yet the chemical methods remain the most widely used and effective method. The Indian farmers have widely accepted the chemical methods of plant protection, which has resulted in the growth of plant protection equipment industry in the country. Presently there are more than 40 organized manufacturers of this equipment in the country. These equipment include stirrup pump or bucket pump, knapsack sprayer, rocker sprayer, foot sprayer, hand sprayer, hand compression sprayer, power sprayers, motorized knapsack mist blower, tree sprayer, ultra low volume sprayer, front mounted self-propelled boom sprayer, power tiller mounted sprayer, rear mounted self-propelled long boom sprayer, tractor mounted sprayer, tractor mounted CDA sprayer, blower sprayer, tractor mounted aero blast sprayer, hand rotary duster, knapsack power duster, tree duster, granule applicators, soil injector, tree injector, dust applicator, fogging machines, electrostatic sprayer, vaporizer and aerosol projector.

Water lifting and irrigation equipment

The human powered devices include swing basket, counterpoise lift, don, Archimedean screw and paddle wheel. The animal powered devices are rope and bucket lift, self empting bucket, two bucket lift, Persian wheel and chain pump. The hydraulic ram is a device to lift water without any prime mover by utilizing the kinetic energy of flowing water. The mechanically powered water lifting devices are usually termed as pumps, which are operated with the help of auxiliary power sources such as engine or electric motor. The pumps are classified as: displacement pumps (reciprocating and rotary), centrifugal pumps (volute, diffuser, turbine and propeller) and airlift pump.

Water lifted from different sources is applied to the crop by various methods. The four common methods employed are: Surface irrigation (border, check basin, furrow and flooding), Sub-soil irrigation, Sprinkler irrigation and drip irrigation.

Harvesting tools

Harvesting of the crop is mostly done manually. The under ground crops are harvested by soil working tools such as spades or hoes. Depending upon the size, hardness and strength of the plant material, which is to be separated, hand tools of various designs are used for different crops. Sickle is used for cutting soft, thin and flexible stems whereas scythes are used for hard thick stems. Special tools are available to suit to the requirement of the specific parts or produce.

Power operated equipment

Although hand tools are important for carrying out all the operations, their use is limited to the small plots for carrying seedbed preparation, sowing and planting operations. For medium to large hectarage, the operations are to be accomplished with bullock drawn, power tiller operated and tractor drawn equipment. The

primary tillage equipment are: wooden plough, animal drawn plough, mould board plough, disc plough, rotavator, chisel plough and sub-soiler.

Cultivators are used for primary tillage operations in light soils and for secondary tillage for breaking up on furrow slice and for weeding and inter-culture of row crops.

The secondary tillage equipment is also manually operated, animal drawn and power operated. The most common animal and power –operated equipment are: harrow, disc harrow, spike tooth harrow, spring tine harrow and blade harrow.

Status of farm power

Agriculture in India continues to depend on power from human, animal, mechanical and electrical sources. The share of mechanical and electrical power increased from a mere 8 per cent in 1960-61 to 45 per cent in 1980-81 and 81 per cent in 1999-2000. The use of animate power on the other hand decreased from 92 per cent in 1960-61 to 45 percent in 1980-81 and 19 per cent in 1999-2000. Punjab is one of the states in the country where mechanical power is used extensively in agriculture. The tractor population has increased from 40 thousand to 450 thousand in the last 35 years. Farm power availability increased from 0.69 kw/ha (1970-71) to 3.76 kw/ha (2000-02).

Farm machinery industry

The uses of bullock drawn implements are expected to decrease due to high maintenance cost of draught animals. The use of tractors, power tillers and irrigation pumps indicate that the use of mechanical power has increased many folds. The number of manufacturers of different items are: tractor (19), power tiller-9, combine harvesters –15, reapers – 45, tractor parts and accessories – 546, earth moving machinery parts – 188, diesel oil engines – 200, rice processing machinery – 300, dairy and food industries – 500, agricultural implements – 6980 and village crafts men – 10 lakhs.

Appropriate mechanization

The states in the eastern part of the country exhibit small fields for which power tiller and matching implements are most suitable for cultivation and its mechanization. The present annual sale of power tillers in the state is about 3000 nos against the requirement of 22000 nos. The lightweight power tillers in the range of 2 to 7 hp are yet to be commercially manufactured. The development of these power units is very vital for small-scale rice field mechanization in the country in general and Eastern Region in particular. The production and sale of power tiller in the country is approximately 30,000 per year. The power tiller is considered to be the best machine for low land small-scale rice cultivation. The mechanized agriculture of Japan, Korea and Chine are based on power tiller and small machines.

The mechanization of agriculture in Japan is a remarkable achievement in the field of small scale rice cultivation. Rice production is completely mechanized starting from planting to processing and value addition. In the year 2000, the number of power tillers, tractors, rice transplanters power sprayers and combines stood at 10.48, 20.28,14.33, 12.69 and 10.42 lakh respectively. Efforts are now being made to popularize four-wheel tractors in 30 hp ranges.

Initiatives are required to manufacture small tillers with matching implements, hand tools and other machinery which will be most suitable for small and women farmers of the state to mechanize the cultivation of aromatic and medicinal plants to enhance productivity and profitability with the least possible associated drudgery.

Fig.1 Power Weeder