



MECHANIZING AGRICULTURE IN HILLS OF HIMACHAL PRADESH, INDIA:A REVIEW

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ABSTRACT

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Agriculture bears great significance in the hilly region of Himachal Pradesh, because more than 90 percent of the population living in rural areas depends directly or indirectly on it. On the other hand, cultivable land is decreasing due to industrialization and urbanization but food demand is increasing with the increase of population. Moreover, this region has advantage and potential to grow different crops due to varying agro-climatic zones. Presently three major crops i.e. wheat, maize and paddy are being grown but with the increasing awareness farmers are diversifying the agriculture with vegetable crops particularly potato, peas and cabbage in selected pockets. Agricultural machinery utilization is very low. Acute labour shortage was noticed in the peak period of farm operations. Among all the farm operations, a notable level of mechanization is achieved in tillage (50 %) and threshing (95 %). Mostly farmers are small and marginal (more than 85 %) and economically poor. Hence it is not possible to own the high cost of farm machines by the individual farmers. At present the power availability is about 0.7 kW/ha in which 40 % met from mechanical power particularly with tractor. The utilization of tractor was almost equal for agricultural and non-agricultural jobs due to small plots. Mechanizing the hill farm is a difficult task because of unique topography, small size plots and non availability of suitable equipments. Thus, adequate and appropriate power source with matching equipment needs to be supplemented as per existing topography for mechanization. This would also be conducive in conducting timely agricultural operations particularly under rainfed conditions. Apart from it, as a consequence of introduction of farm mechanization, farmers would get more leisure and can easily devote more time for other non-agricultural jobs.

INTRODUCTION

Agriculture is the backbone of Indian economy as it provides direct employment to about 69 % of the working people. Being the largest source of employment and income to millions of people, it also provides a vast market for our industrial products. The country has made a three-fold increase in food grain production from a level of about 55 million tonnes in 1970-71 to 212 million tonnes in 2003-04 and contributes about 29.1 % of gross domestic product. Further, Indian agriculture is characterized by small and fragmented land holdings, hill farming and shifting cultivation with 1.55 hectare as the average size of farm holding. About 78 % of the farmers possess an area less than 2 hectare with poor resources at their command, especially in the dryland regions.

Himachal Pradesh is a hilly state of India situated between 30.3 and 33.3⁰ North Latitude and 75.3-79.0⁰ E Longitude. The elevation of the state widely ranges from 350 m to 6975 m above mean sea level. On account of wide variations in altitude and topography, the state has broadly been classified into four agro-climatic zones, i.e. sub montane and low hills sub-

tropical, mid hills sub humid, high hills temperate wet and high hills temperate dry (Fig 1).

Agriculture Scenario

In the hilly region of Himachal Pradesh, agriculture bears great significance because more than 90 percent of the population living in rural areas depends directly or indirectly on it and also contributes significantly to the state economy. Majority of these ruralises are either cultivators or agricultural labourers. The food grain production in the state is stagnating at about 1250-1700 kg/ha for the past one decade inspite of providing modern inputs like seed, fertilizer etc. To have a better idea, the food grain production in Himachal Pradesh has been compared with that of the neighbouring state like Punjab as well as the country as a whole and depicted in Table 1. It is clear from the table that the average yield of food grain per unit area in Himachal Pradesh is quite low as compared to Punjab or India and needs to be enhanced through appropriate modernization of agricultural technology. The area and production of main crops is given in Table 2. The farmers use traditional tools and

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mostly rely on animate power (Fig 2). It was also noticed that women folk are being used as major force in farming (Fig 3). In Himachal, marginal and small farmers dominate the peasantry constituting more than 84 % of the farmers having an average holding of about 0.65 hectare (Table 3). The performance of equipments used and a view of different zones of Himachal Pradesh is given in Table 4-5.

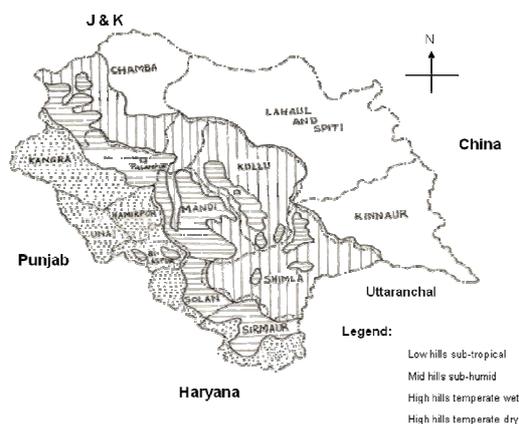


Fig 1. Agro-climatic zones of H.P. Status of Hill Farming

Table 1. Comparison of area and food grain production

| | HP | Punjab | India | |
|----------------------------|------|--------|--------|-----------|
| Area, million ha | 0.80 | 6.10 | 121.61 | |
| Production, million tonnes | | | 34.89 | 252.03 |
| Average yield, kg/ha | | | 1680 | 4640 2139 |

Table 2. Area and production of main crops in HP

| Crops | Area, 000ha | Production, 000MT | Average Yield, q/ha |
|------------|-------------|-------------------|---------------------|
| Rice | 82.8 | 115.3 | 13.9 |
| Wheat | 374.9 | 609.5 | 16.2 |
| Maize | 308.5 | 623.7 | 20.2 |
| Barley | 26.3 | 34.1 | 13.0 |
| Potato | 14.2 | 135.3 | 95.2 |
| Fruit crop | 207.2 | 628.1 | |

To some extent, improved hand tools like serrated sickle, maize sheller, knapsack sprayer and chaff cutter were used by the farmers. Similarly, the major equipment used with bullock power was indigenous plough, soil stirring plough, clod breaker, planker and bar harrow out of which the most common was soil stirring plough which was possessed by 64-67 % of the farming families. The tractor/power operated equipment were available with the large category of farmers and found significantly higher as compared to other farm groups but their number was very small.

Table 3. Average size of land holding in Himachal Pradesh and India

| Farmers category | Size, ha | Number of Holdings | | Area, ha | | Average holding, ha | |
|------------------|----------|--------------------|-----------|----------|-----------|---------------------|-------|
| | | HP | India | HP | India | HP | India |
| Marginal | < 1 | 555891 | 71179000 | 230305 | 28121000 | 0.41 | 0.40 |
| | | (64.4 %) | (61.6 %) | (23.1 %) | (17.2 %) | | |
| Small | 1-2 | 173466 | 21643000 | 240483 | 30722000 | 1.38 | 1.42 |
| | | (20.1 %) | (18.7 %) | (24.1 %) | (18.8 %) | | |
| Semi-medium | 2-4 | 94957 | 14261000 | 255195 | 38953000 | 2.68 | 2.73 |
| | | (11.0 %) | (12.3 %) | (25.5 %) | (23.8 %) | | |
| Medium | 4-10 | 34377 | 7093000 | 194782 | 41398000 | 5.66 | 5.84 |
| | | (4.0 %) | (6.1 %) | (19.5 %) | (25.3 %) | | |
| Large | >10 | 4746 | 1404000 | 78334 | 24163000 | 16.51 | 17.21 |
| | | (0.5 %) | (1.2 %) | (7.8 %) | (14.8 %) | | |
| Total | | 863437 | 115580000 | 999099 | 163357000 | 1.15 | 1.41 |
| | | (100 %) | (100 %) | (100 %) | (100 %) | | |

Table 4. Performance of traditional tools and equipments

| Hand Tools & Implements | % Farmers using | Source of Power | Field Capacity, ha/h |
|-------------------------|-----------------|-----------------|----------------------|
| Indigenous Plough | 11 | Bullocks | 0.020 |
| Soil stirring plough | 89 | Bullocks | 0.023 |
| Planker | 100 | Bullocks | 0.20 |
| Wooden clod breaker | 84 | Manual | 0.009 |
| Khunttee | 100 | Manual | 0.003 |
| Sprayer | 22 | Manual | 0.06 |
| Sickle | 100 | Manual | 0.008 |

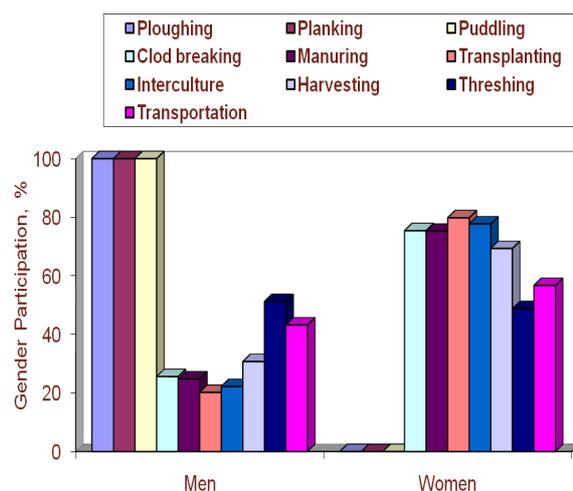


Fig 3. Gender participation in various agricultural activities



Fig 2. Traditional tools used in HP

Table 5. A view of four agro-climatic zones of Himachal Pradesh

| Particulars | Overall view | Agro-climatic zones | | | |
|----------------------------|--------------|--|--|---------------------------------------|---------------------------|
| | | Sub montane and low hills sub-tropical | Mid hills sub humid | High hills temperate wet | High hills temperate dry |
| Geographical area, 000 ha | 5567.3 | 913.2 (16.4%) | 1183.2 (21.3%) | 1280.9 (23.0%) | 2190.6 (39.0%) |
| Total cropped area, 000 ha | 956.8 | 335.1 (38.0%) | 383.4 (41.0%) | 171.8 (18.4%) | 24.3 (2.6%) |
| Elevation (amsl), m | - | Below 650 | 651-1800 | 1801-2200 | Above 2201 |
| Soil texture | - | Coarse | Coarse | Shallow in depth & sloppy | Coarse |
| Irrigated area, % | 101.9 | (16.6%) | (17.3%) | (7.8%) | (10.6%) |
| Rainfall, mm | - | 1000 | 1500-3000 | 100 | 250 |
| Field crops | - | Wheat, Maize, Rice, Pulses | Rice, Wheat, Maize, Barley, Pulses | Wheat, Maize, & Potato | Barley, Potato & Wheat |
| Fruit crops | - | Subtropical fruits. | Apple, Other temperate fruits, Stone fruits, Nuts, Mango & Litchi. | Apple, Other temperate fruits & Nuts. | Nuts, Dry fruits & Apple. |

Mechanization Scenario

The share of animate power has declined and the role of mechanical power enhanced in Indian agriculture during 1960-2000. In India, the power availability increased from 0.32 kW/ha in 1967 to 1.5 kW/ha in 2010 whereas Himachal Pradesh realised very little increase from 0.37 kW/ha to 0.67 kW/ha between 1977-o 2012. The total power available from animate and inanimate is also presented through figure 4. Women (and often children) play a very important role in many farming based communities; up to 80% of the total farm labour comes from women. Therefore gender issues should comprise

an important part of any study, particularly in connection with farming systems and post-harvest processing.

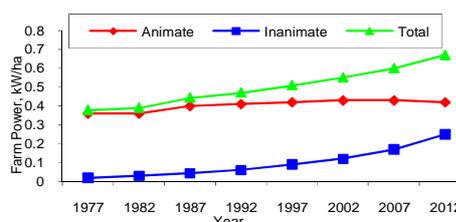


Fig 4. Availability of Farm Power from Various Sources

The impact of mechanization can be highlighted through farm power availability and productivity relationship (Fig. 5). The figure depicts that productivity increases with power availability. Lack of mechanization puts new demand on farm power and machinery, specifically for this hilly region. The availability of agricultural equipment is also very low (Table 6). In addition, the condition of hill farmer is somewhat different from that of farmer from the plain as his land holding is much smaller and fragmented. The crops are mostly grown under unique topographical situations in very small plots having average size in the range of 100–200 m² under rain-fed conditions. The rain-fed scenario forces the farmers to grow the crop in a limited time. However, conducting timely operations under rain-fed conditions is very difficult. On the other hand, topography is restricting the introduction of large mechanical power like tractor in most of the region. Therefore, appropriate selection of power-equipment system is extremely important for determining the net returns in agriculture for a given farming situation, which not only enhances the annual machine use but also limits the operational costs and energy consumption.

Mechanization plays an essential role in agriculture and assures timely completion of farm operations as well as less expenditure per unit area. The draft of National Policy of Agricultural Mechanization prepared by the Central Council for Agricultural Mechanization set-up by the Ministry of Agriculture in 1998, observed that with the emphasis on timeliness, precision and general improvement in the quality of work, farm mechanization has resulted in the increase in cropping intensity, yield and employment. No emphasis has yet been laid to modernize the farm particularly with improved farm tools and equipment for augmenting the crop production in the hilly state of Himachal Pradesh. The modern techniques of crop production have not only created an impact on increasing productivity but also on reducing drudgery involved in farming operations, which directly or indirectly attract the farming community. Therefore, agricultural development has more relevance in hills for obvious reasons of livelihood and socio-economic up-liftman. More power is essential in carrying out operations effectively at the right time and for changing the attitudes and uplifting the social status and dignity of those who work in agriculture. More power provides opportunity for designing a whole new array of modern implements that perform their functions better and quicker invariably require more horse power per hour and per hectare. Without the availability of additional power, it is very difficult to design good implements. Attempts to improve bullock-drawn implements may have popular appeal but one must accurately assess the actual capacity if real progress is to come. Not only are these hill farmers demanding the agricultural machines for different farm operations (Table 7).

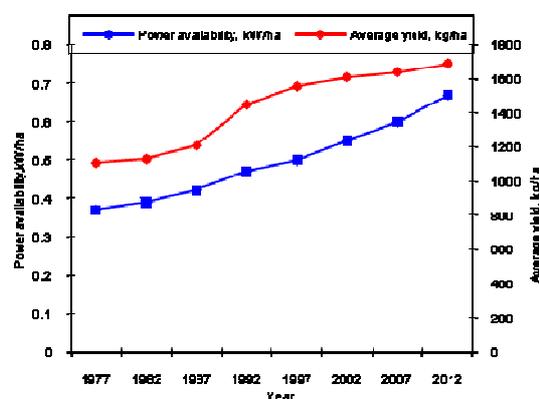


Fig 5. Relationship between farm power availability and food grain productivity

Table 6. Number of power sources and implements in HP

| Type of power source | Number | Type of implement | Number |
|----------------------|----------|----------------------|----------|
| Bullocks | 7,79,231 | Indigenous Plough | 95,023 |
| He-buffaloes | 7,627 | Soil Stirring Plough | 7,03,884 |
| Mules | 16,390 | Sprayer | 11,617 |
| Yak | 5,697 | Maize Sheller | 1,037 |
| Donkey | 7,447 | Thresher | 2,692 |
| Tractor | 3,466 | Bullock Cart | 1,128 |
| Diesel Engine | 1,299 | Cane crusher | 1,878 |

Table 7. Farm power source and implements required by farmers

| Type of power source, tools and implements | Response of various farm groups, % | | | |
|--|------------------------------------|-------|--------|-------|
| | Marginal | Small | Medium | Large |
| Manual drawn improved seed drill, paddy transplanter, sickle, weeder, paddy thresher | 58.5 | 18.6 | 7.8 | 2.0 |
| Animal drawn improved plough, clod breaker, seed drill, potato planter, digger | 31.2 | 32.8 | 21.3 | 10.4 |
| Power tiller with matching implements | 10.3 | 42.4 | 39.2 | 29.0 |
| Tractor with matching implements | - | 6.2 | 31.7 | 58.6 |

Future Thrust

- ❖ Design and Development of ergonomically suitable tools and equipments for hill agriculture
- ❖ Need to develop women friendly tools & equipments for hills
- ❖ Need of ergonomically suitable light weight power tiller for high hills
- ❖ Introduction of appropriate & suitable horticultural tools

Strategies for Hill Farm Mechanization

The strategies need to be adopted to achieve appropriate farm mechanization in the hills can be listed as follows:

- a) **Design and development of low-cost improved hand tools/equipment** especially for marginal and small farm groups.
- b) **Design and development of new animal-drawn equipment** to increase the annual utilization of animals as well as to introduce the already available improved ones after proper testing in the hilly areas.
- c) **Introduction and development of specific power source and equipment** which is light in weight, small in size, low in turning radius, easy to handle/carry from one plot to the other.
- d) Introduction of **crop-specific package of tools and equipment** for different soil conditions.
- e) **Systematic testing of the available tools/equipment** particularly on ergonomical aspects to reduce drudgery of farmers.
- f) Introduction and **popularization of commercially available power tillers** to reduce the drudgery of the farmers and also to encourage the educated youth to go for opening custom hiring centres rather than searching white collared jobs in the governmental sector.
- g) **Awareness camps and demonstrations** need to be arranged for promoting and disseminating improved farm technologies on a larger scale at different locations in the state.
- h) **Development of proper infrastructure and trained technical man-power** for conducting demonstrations and trainings on improved tools/equipment in all parts of the state.
- i) **Establishment of small-scale units** for manufacturing tools/equipment at different locations in the hilly region.
- j) **Strengthening of a network of repair and service facilities** for the machines/tools in the region.
- k) **Formulation of adequate farm mechanisation policies** and programmes by the state government to increase the productivity of hill agriculture.

- l) Establishment of an **Advanced Centre for Hill Mechanisation** for sustainable development of agriculture in the state

CONCLUSION

- ❖ More than 80% farmers belongs to marginal & small groups
- ❖ Mostly farmers using bullocks & traditional tools for farming
- ❖ Farm women engaged in most of the farm operations.
- ❖ Mechanical power (tractor- 20%) was used by large & medium farmers in low hills
- ❖ Good potential for introducing suitable tools and implements as well as existing power tiller particularly in low & mid hills

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