

## **Small Scale Mechanization for Increasing Productivity in Maize Crop**

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### **ABSTRACT**

Maize is one of the important crops for cereal and fodder production in the state and occupies the largest area under cultivation in J&K. Most of the rain fed areas in the state is under maize cultivation as it requires minimal water for its growth. In the study to improve the productivity of maize and reduce the associated drudgery with maize cultivation a number of implements were fabricated by the division. The implements fabricated and tested included maize planter, wheel hoe, harvesting seat, horizontal and vertical maize shellers. The implements fabricated performed a wide variety of operations in maize cultivation like sowing, hoeing, ease in harvesting and maize shelling. The field testing of the implements showed considerable reduction in drudgery and increase in productivity of the crop.

**Key word:** Mechanization, productivity, maize crop.

### **INTRODUCTION**

Maize (*Zea mays* L.) also called as corn, is the second highest produced cereal grain crop of the world. It is one of most intensively cultivated crop in India. In J& K state the area under cultivation of maize is highest than any other crop. It has gone up from 203 in 1955-56 to 330.21(000 ha.) in 2000 -2001 (Anonymous, 2001). The state of mechanization with regard to maize production in the Kashmir valley especially in the hilly regions of valley temperate zone is still in its infant stages.. Mechanization of farms helps in reduction of human drudgery besides ensuring the timeliness of operation and solving the problem of scarcity of labours during peak cropping season( Annual report, 2004). It is an important means of increasing agricultural productivity through efficient utilization of biological and chemical inputs besides helping to achieve timeliness of operations and improving the quality of crop. Though modernizations and technology advancement is taking place at a rapid pace, yet there exist a large mechanization gaps in the region.

## **MATERIAL AND METHODS**

Due to undulating topography and fragmentation of land in small pieces, the mechanization in Jammu and Kashmir State is very limited. In the region traditional tools and implements evaluated and developed in isolation by small group of farmers had remained as the only mechanical gadgets available for cultivation practices. Desi plough, Shalimar plough, tangroo, shovel, sowing by kera and broadcasting etc are still used by the farmers in these regions. Animal power continues to dominate as the most frequently used source of power. Much of the labour and inputs is wasted when indigenous implements are used for field preparation, sowing, weeding, harvesting and thrashing ( Sahay, 2002). A number of small tools and implements were fabricated at the university for performing a wide variety of operations like sowing, deweeding, harvesting and shelling

### **Maize Planter**

Manually operated maize planter can be effectively used for sowing of the maize seed. The maize planter is provided with small cup which moves in a circular motion along with the rotation of the maize planter (Fig.1). The cup like small bucket holds three to four seeds at a time and drops them at regular intervals. Both plant to plant spacing and row to row spacing can be maintained with the use of maize planter. The working of the maize planter was done at Dara, Harvan area of Srinagar district in the year (2003-04). The testing of the implement (Fig. 2) was done for the following variety, treatments and replications:

- 1) Variety: C-15
- 2) Treatments: 3
  - (i) Sowing by Maize Planter (M1)
  - (ii) Line sowing (making line with local tool, tangroo and sowing manually, (M2) (iii) Broadcasting (M3)
- 3) Replication: 4

### **Wheel Hoes**

A shovel type single and double row wheel hoe can be efficiently used for intercultural operations in maize. In order to provide more power to the operator a larger diameter wheel can be preferred to minimize the application of force and for ease in its operation. Human being can operate the single row wheel hoe ( Fig. 3), The dimensions of the wheel hoe are as below:

Overall dimensions: Length - 1560mm, width - 470mm and height - 800mm

Ground wheel: Diameter - 650mm, width - 40mm

Beam: Rectangular section, length - 430mm

Weight of single wheel hoe: 12.2 kg

### **Harvesting Seat**

The drudgery associated with the harvesting operation has been effectively reduced by a wooden harvesting seat (Fig. 4). The seat is attached to a labourer by belts on the torso and either sides of the hips. During the harvesting operation the labourer can tie this seat to his rear and helps in dissipation of load of the worker.

### **Maize Shelling**

It is a common practice among the farmers especially in the hilly regions that maize is thrashed either by beating and by hand rubbing of cobs. Beating operation damages the grains and rubbing requires more energy and time and also large shelling machines are not found economical for the farmers due to small land holdings, high price and lack of technical know - how. It was also found out during different surveys that the farmers were not aware of the right time of harvesting as they were lacking the scientific techniques to determine the moisture content of maize cobs. The Horizontal Maize sheller is 6.1cm in diameter and 7.0 cm length with tapered fins and can be effectively used for shelling of maize cobs (Fig: 5). The vertical maize sheller is provided with with bevel gear mechanism for transferring horizontal motion into circular motion. The material used in fabrication of the sheller is M.S. pipe with tapered fins and a handle (Fig. 6).



Fig 1. Maize Planter



Fig 2. Working of maize planter



Fig 3. Wheelhole



Fig 4. Harvesting seat



Fig 5. Horizontal Maize sheller



Fig 6. Vertical maize sheller

**RESULTS AND DISCUSSION**

The feasibility testing of the manually operated maize planter with respect to sowing by tangroo and traditional method of harvesting are given in table 1 to 5. The average capacity, plant height, number of cobs per plant, length of the cobs (cm), Average grain yield (q/ha.) and labour requirement (man-hr/ha) for maize planter were found to be 1.71, 1.80, 11.81, 42.78 and 38.46 respectively of maize

**Table 1. Plant height (m) of maize crop at maturity stage**

Treatments	Replication				
	R1	R2	R3	R4	Mean
M1	1.76	1.74	1.69	1.65	1.71
M2	1.70	1.67	1.60	1.63	1.65
M3	1.69	1.59	1.62	1.59	1.62

**Table 2. No. of Cobs per plant of maize crop.**

Treatments	Replication				
	R1	R2	R3	R4	Mean
M1	1.80	1.90	1.70	1.80	1.80
M2	1.90	1.75	1.82	1.70	1.79
M3	1.3	1.1	1.0	1.5	1.22

**Table 3. Length of Cobs (cm.) of maize crop.**

Treatments	Replication				
	R1	R2	R3	R4	Mean
M1	11.90	10.85	12.50	12.00	11.81
M2	12.50	12.80	11.90	13.50	12.67
M3	10.50	9.50	11.00	9.50	10.12

**Table 4. Average grain yield of maize (q/ha)**

Treatments	Replication				
	R1	R2	R3	R4	Mean
M1	45.10	42.50	41.10	42.0	42.78
M2	44.10	43.0	41.0	42.5	42.65
M3	39.50	38.0	39.0	38.10	38.65

**Table 5. Labour requirement for maize sowing under different methods of sowing.**

<b>Methods of sowing</b>	<b>Operating speed (km./hr.)</b>	<b>Field capacity (ha./hr.)</b>	<b>Labour requirement (man-hr./ha.)</b>
M1	2.69	0.052	38.46
M2	2.37	0.039	51.28
M3	-	-	-

Hand operated two tyne maize hoe was also evaluated for interculture operations in maize crop. The percentage saving of labour in comparison to traditional method was 73.6% and percentage increase in yield in comparison to traditional method was 8- 10%.

The average shelling capacity of horizontal maize sheller was found to be 15.33 kg per hour. The cost of shelling per kg with the implement is 1.01Rs/kg. The percentage saving in cost of operation in comparison to conventional method of shelling is 60.23. The percentage increase in shelling rate as compared to traditional method of shelling was 64.0%. The average shelling capacity of vertical maize sheller was 17.40 kg per hour. The cost of shelling per kg with the implement is 0.90Rs/kg. The percentage increase in shelling rate is 66.50.

### **CONCLUSIONS**

- The use of the Maize Planter helps in maintaining optimum plant density and constant row to row and plant to plant spacing provided the soil is in good tilth.
- Considerable saving of seed, labour and time is achievable by making use of the planter.
- Deweeding operations can be easily undertaken with a manual deweede.
- The average yield, number of cobs, plant height, and length of the cobs with maize planter is greater than that obtained with conventional methods of sowing.
- The drudgery and low efficiency associated with manual methods of maize cultivation can be reduced to a great extent by use of these small tools and implements.
- Harvesting seat can be used quite effectively during harvesting operations

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