

Engineering interventions for potato production

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Timely field operations and handling of potato crop are important factors for improving quality and quantity in potato production. Complete manual potato production requires about 1600-2000 man-hours per hectare. During the past decades, lot of research work was done for mechanization of potato crop. As a result, now we have a number of good machines and equipment for potato cultivation to perform operations like land leveling, seed bed preparation, planting, weeding and interculture, plant protection, digging, grading and seed treatment.

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INDIA is second largest potato producer next to china. Potato is a short duration crop, having highest yield per day per unit area as compared to other major crops like wheat, rice and maize. Efforts have been made at various levels to mechanize both production and processing. Potato is bulky and watery in nature and requires lot of energy for production and processing. Manual production of potato is time consuming and tedious job, it requires about 1600-2000 man-hours per hectare.

Potato production technology

Timely field operations and handling of potato crop are important factors for improving quality and quantity in potato production. Several machines and equipments have been developed

for various operations of potato crop cultivation. Now we have a number of good machinery and equipments for potato cultivation to perform various field operations like land leveling, seed bed preparation, planting, weeding and interculture, plant protection, digging, grading and seed treatment.

Seedbed preparation

After burying green manure crop (usually *dhaincha*) with disc harrow (Fig. 1) or rotavator followed by one leveling makes field conditions favourable for decomposition of green manure. Pre-sowing irrigation is done to have uniform germination. After 5-7 days of pre-sowing irrigation, 2-3 cross harrowing or 3-4 tiller operations followed by two leveling make the required seedbed for a good crop of potato. All these

equipment are easily available in the market and are being used for other crops also.

Fertilizer application

Fertilizer type, quantity and placement are the important factors for good production of any crop. After seedbed preparation, a fertilizer drill-cum-marker or fertilizer broadcaster can be used for fertilizer application. In case, fertilizer unit is attached with the planter than the use of fertilizer drill can be avoided. In potato crop, fertilizer should be placed 5-7 cm below the seed tubers and should not come in direct contact with the seed. Band placement helps in improving efficient utilization of fertilizer which results in improved production. Generally, fertilizers are hygroscopic in nature, hence it is recommended to properly clean the applicator after use.

Planting

About 80-85 thousand plants per hectare are required for good yield of potato crop. This can be achieved by planting 40-60 g of potato tuber i.e. 35-40 quintal seed tubers per hectare. Uniform placement of tubers in prepared



Fig. 1. Deep tillage with subsoiler and rotavator operation for seed bed preparation

soil bed at specified spacing and depth is also important for better emergence as well as production of the crop. Uniform plant emergence can be achieved by planting of seed material with tractor operated potato planters. These machines maintain uniformity of planting in terms of row-to-row (60 cm), plant-to-plant (20 cm) spacing and depth (6-8 cm) of planting. Various types of machinery are available (Fig. 2) in India for planting of potato viz.

- Rotating drum type
- Revolving magazine type
- Belt and cup type
- Picker wheel type

First two are semi-automatic type planters in which one person per row puts seed tubers in to the seed metering cells of the machines. Function of these machines is to open a furrow and drop the seeds in to the soil through seed delivery tubes. Seed tubers are dropped in lines and a ridge of soil mass is formed over the tubers. Automatic planters are becoming popular now-a-days due to their distinct advantages over the other types. In this type of machine, labour is required only for filling of hopper. All other activities like lifting individual tubers, dropping them into rows and then covering with soil mass are carried out by the machine itself.



Fig. 2. Potato planting with automatic and semi-automatic planters

Weeding, top dressing and earthing

Mechanical and chemical weed control methods are used in most of the crops now-a-days. Potato being a tuber crop, is highly responsive to inter-row-cultivation. Five row tractor operated inter-row-cultivator is operated in 22-25 day crop when plant height is 8-10 cm (Fig. 3). After operating this weeding machine, three or five row ridger is used for earthing up and remaking the ridges. Ridger makes uniform ridges and accumulates sufficient soil mass around the plants. For light soils and low weed intensity areas, another multipurpose machine is available which perform weeding, furrow opening, fertilizer application and re-earthing operation simultaneously. For chemical weed control, tractor operated multi-nozzle sprayer or spray gun are used to achieve fast and uniform coverage.



Fig. 3. Weeding, top dressing and earthing operations in potato crop



Plant protection

Potato crop needs to be protected from different disease carriers, insects and pests by applying respective chemical formulations. Many times delay in chemical spray can cause huge crop losses. Particularly, in case of late blight disease. Delay of 1-2 days can result in total loss of crop. Therefore, timely and uniform application of plant protection chemicals is very important, which is possible with high capacity tractor operated sprayers. Multinozzle boom sprayer, having 12-16 nozzles, is also useful for potato crop. However, spray gun is most popular in northern region of the country which is especially effective in case of late blight in potato plants (Fig. 4).

For small holdings, manually or battery operated knapsack sprayer can be used which has field capacity of 0.5 ha/hr.



Fig. 4. A view of spraying operation with power sprayers

Potato digging

Before starting harvesting operation, haulms are removed manually or with chemical methods. Potato digging is a cumbersome process and involves a lot of manpower. About 600-700 man-hours are required for manual digging of 300-400 quintals of potato from huge soil mass of around 10,000 quintals. In manual harvesting, spade or *khurpa* is used which results up to 10% tuber cut or bruise which is a huge loss to the farmers and nation. In manual harvesting, some portion is always left behind in the field. Animal drawn plow is another tool for potato digging. This method is faster as compared to manual digging but in case of large scale farming, harvesting is delayed and

fields become dry. Tractor operated diggers are the fast, economical and cause least damage to the produce.

Digger elevator is an efficient machine which exposes 90-95% tubers in optimum field conditions (Fig. 6). This machine is expensive to maintain as there are many parts which move in soil and cause more wear and tear. Multipurpose potato digger is another less expensive equipment. It exposes about 80-85% potatoes and is easy to maintain. It can be used in early crop (60 days without cutting haulms) and also can successfully work in dry field conditions.

Potato-sugarcane intercropping is a highly remunerating cropping system. But potato digging from this intercrop is a difficult task. Recently, a new digger has been developed at CPRI Campus, Modipuram, for this intercropping. This equipment is helpful in digging potatoes without damaging sugarcane crop. Simultaneously, interculture of sugarcane crop is also completed.



Fig. 5. Potato harvesting with tractor operated digger elevator



Fig. 6. CPRI Potato combine harvester

Potato combine harvester is very useful machine for performing the unit operations from digging to packaging of potato in one go. Function of the combine harvester is to dig out the potatoes from soil, lift the dig out tubers along with the soil mass, separate the tubers with soil by shaking action, sorting of the rotted tubers or soil clodes and packaging in the bags.

Grading

Graded, sorted and properly packed potatoes always fetch good price in the market. Manual grading is not uniform and it requires a lot of time and energy which bring down the overall returns. For fast and uniform grading, various power operated graders have been developed and widely used by potato growers. However, the rubber belt screen type grader is most popular due to its uniform grading with negligible mechanical damage, high material capacity and ease of operation.

Seed treatment

To grow a healthy potato crop, disease free seed is the most important requirement. For controlling tuber and soil borne diseases viz. common scab, black



Fig. 7. Potato sorting and grading line

scurf and powdery scab, 3% boric acid treatment can be given with the help of a motor operated seed treatment machine. In this machine, boric acid is sprayed on the potatoes moving and rolling over a conveyor. All the surfaces are coated with the chemical and the used solution is re-circulated. This machine can treat about 300-350 quintals of potatoes per day.

SUMMARY

Potato is a crop with huge production per unit area. For production, handling and processing of this much of quantity of produce, it takes lot of time and energy if all the operations are completed manually or with the help of animal drawn equipments. For timely operations of seed bed preparation, fertilizer application, planting, weeding, earthing, digging, grading, seed treatment and processing of end produce, there are many efficient machines and equipment available now in India. Therefore, in this era of competitive agriculture, for efficient use of expensive inputs like seed and fertilizer, farmers should opt for mechanized potato cultivation and should use potato planters, fertilizer applicators, weeders, diggers, graders and other machinery. Of course some of these machines are expensive and are not in the reach of small farmers. In that case, a group of farmers can purchase the machine or an individual farmer can have it and can go for custom hiring for more returns. Similarly, cooperatives can be a useful idea for having processing machineries at village or cluster levels.

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