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Enhancement of Production by Development of Resources in Critical Production Operations in Multi Crop Seed Conditioning Unit

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Abstract- This paper is aimed at enhancing production of multi seed conditioning plant by utilization of resources in critical production operations. Seed is the most important input component for productive agriculture. In the significant advances that India made in agriculture in the last four decades, the role of the seed sector has been substantial. The expansion of seed industry has occurred in parallel with growth in agricultural productivity. Seed processing and conditioning improves genetically and physical purity of seed. It is an established fact that good quality seed is a pre-requisite for optimum return of the crop. Most of the agriculturally advanced countries have legislative measures governing the quality of seed sold to farmers. The methodology followed for conducting the study plays an important role in obtaining reliable results. The present study was conducted to understand the present production operations, identification of critical production operations, evaluation, optimization, and development of various resources allocated in the critical production operations of multi crop seed conditioning plant. The activities which have high man machine relations are identified they are feeding, fine cleaning, destonening, specific gravity, treatment chamber and packing. These activities in the plant are semi automated which requires a good pace of man machine relationship. So, these activities are critical for production. Physical resource used at present are calculated to being utilized at 48 % capacity of their installed capacities. To enhance the production efficiency few physical resources should be added like pre cleaner machine to the processing activity and a full time fork lift at feeding. Operators feel that they require new training to develop there skills in operating and enhance productivity once year, operator's camp has to be conducted during the off seasons of plant to share the observations and experience with all other operators to increases the experience curve in short duration. All the operators feel that there is no evaluation procedure for appraisal of performance of operator and motivations factors like variable payment for good performance, recognition, growth and advancement which are very important to enhance the productivity, performance and reduction of the human resources. At present enterprise resource planning systems are being used in the plant used at the management level only, and there is no access for the operator who are directly involved in the production process. The experience curve is very important for any organization which involves high skill involved activities, the turnover rate of operators in the production operations is high, so the information system should be developed to record the experience of operating the machinery in the plant. The physical, human, information resources should be developed for efficient utilization of financial resources of the plant.

Index Terms- Multi seed processing plant, Production operations, production efficiency, critical production operations

I. INTRODUCTION

Seed is the most important input component for productive agriculture. In the significant advances that India made in agriculture in the last four decades, the role of the seed sector has been substantial. The expansion of seed industry has occurred in parallel with growth in agricultural productivity. The organized seed industry of the country is just forty years old. This paper is based on the data from pure observations from the study made in prominent multiple seed conditioning plant in Andhra Pradesh. This paper is aimed at enhancing production of multi seed conditioning plant by utilization of resources in critical production operations.

INDIAN SEED INDUSTRY

Indian seed market estimated at US $ 1.1 billion and is the 6th largest in the world. Currently it is growing at rate of 12% per annum compared to world seed market which is growing at less than 5% per annum. Indian seed industry used to be dominated by public sector seed companies. However, following the easing of government regulations and the implementation of a new seed policy in 1988, the private sector seed companies have started playing a major role in seed development and marketing. The composition of the seed industry, by volume of turnover, has reportedly reached a ratio of 60:40 between the private and public sectors.

The most important characteristic, if it can be called that, of the seed industry is its heterogeneity in many dimensions. The product segments correspond to all the major field crops and vegetables. With respect to product type, a major distinction is between hybrids and open-pollinated varieties. Seeds of varieties can be reproduced for many generations with little deterioration in quality. As a result, beyond the initial purchase, farmers can multiply their own seed. This is not a viable strategy with hybrids because they suffer noticeable declines in yields in subsequent generations. As a result, hybrid seed tend to be repeatedly purchased. The major cereals of rice and wheat are principally open-pollinated varieties. Hybrids dominate in coarse

cereals consisting of sorghum, pearl millet and maize. Hybrids are also important in cotton and oilseeds.

In terms of organization, the seed industry consists of a large public sector and a growing private sector. The public sector consists of the National Seed Corporation, the State Farm Corporation of India and 13 State Seed Corporations. These corporations multiply and market varieties bred by the public sector institutions, i.e., the research institutes financed by the Indian Council for Agricultural Research (ICAR) and the State Agricultural Universities.

There are no firm estimates of the number of private seed firms. Estimates vary from 200 to 500. Private seed firms are heterogeneous with respect to size, research capacity and product segments. Plant breeding research is found in the larger firms. Unlike the public sector, where research is separate from seed production and marketing, these functions are integrated in the private firms. The other striking difference is in product types. The private sector focuses largely on hybrid seed. It is therefore unimportant in the product segments of wheat and rice except as a seller of public varieties and hybrids. On the other hand, the private sector is a major player in the hybrid seed markets of vegetables, sorghum, oilseeds (e.g., sunflower), maize, cotton and pearl millet. In terms of ownership, private firms are closely held and not listed in the stock exchanges although some of the large firms have sold equity to foreign seed companies. Foreign firms maintain a presence through equity stakes in Indian firms, technical alliances or through wholly owned subsidiaries.

Seed firms, whether in the private or public sector, outsource the production of seeds to contract growers. These growers are supplied with the foundation seed that is used to produce commercial seed. The seed industry is one of the earliest examples of contract farming in India. For the cereal crops of rice and wheat, the principal source of seeds is not the seed industry whether private or public but the farmers themselves. Seed saved from the preceding crop supplies nearly 90% of requirements in these crops. In some cases, a large farmer or groups of farmers specialize in growing seeds and supply to neighboring areas. In the case of sorghum, maize and sunflower, the proportions of seed supplied by the commercial seed industry ranges between 25% and 43%.

IMPORTANCE OF SEED PROCESSING AND CONDITIONING

Seed processing and conditioning improves genetically and physical purity of seed. The economic importance of genetically and physically pure seed of high-yielding varieties and hybrids has been receiving increased recognition. It is an established fact that good quality seed is a pre-requisite for optimum return of the crop. It is the cheapest input and forms only a small fraction of cultivation expenses. Good quality seed offers great production potential. Most of the agriculturally advanced countries have legislative measures governing the quality of seed sold to farmers. In India, until recently, there was no such legislation, except in Jammu & Kashmir where an Act in respect of vegetable seed only was in force. In order to ensure supply of good quality seed to the tillers of the land and to protect the honest seed dealers, it was considered necessary to enact suitable legislation for the country. On the 29th December 1966 the Indian Parliament passed the Seeds Act 1966 for regulating the quality of seeds sold in the country for the purpose of agriculture. The Act has been in force in the whole of the country with effect from 1st October, 1969. It extends to the whole of India. It is applicable to seed and vegetative propagating materials of food crops including edible oilseeds, fruits, vegetables, pulses, sugars, starches, cotton and fodder crops. Even in these groups it is applicable to seed of only certain kinds (crops) and varieties called the notified kinds and varieties notified under Section 5 of the Act. It is not presently applicable to fiber crops such as jute and mesta, plantation crops such as rubber, cocoa, coffee, and tea, essential oils such as eucalyptus, ornamental flowers, and narcotics such as tobacco etc.

The Act attempts to regulate the quality of seed sold by providing for compulsory labeling and for voluntary certification. In the former, any one handling seed of a notified kind or variety must ensure that the seed confirms to certain minimum limits of germination and purity and that the seed is labeled as prescribed. In the later, namely, voluntary certification, any one desirous of having the seed certified can have it done by a certification agency. Seed processing is an important phase of the certification process and is responsible for upgrading seed quality by removing foreign material, inert matter undersized seed, weed seeds, off-size and deteriorated and damaged seeds and by improving the planting condition of the seed to achieve the purity percent and germination of the seed harvested in the production farms. Seed conditioning is process in which the harvested seed is brought to uniform in size, moisture percentage and improve appearance by usage of dyes and polymer to make it attractive in the market. It also includes seed treatment with recommended fungicides and pesticides as per the crop requirements.

PRODUCTION OPERATIONS IN A MULTY SEED CONDITIONING PLANT

The seed harvested is called as raw seed before subjecting to processing, the raw seed is brought in trucks in gunny bags or jumbo bags or bulk bins to processing plant. Paddy, pearl millet, mustard, sunflower are threshed in field itself were as corn is brought in the form of cobs and it is shelled in the plant. The seed which arrives at the plant is subjected to drying in the dryers at the plant to achieve the required moisture level between 9 and 11.5 % during the harvest season from January to March. And seed are stored in the ware houses at the plant either in gunny bags or jumbo bags or bulk bins and are processed as per the processing schedule prepared by the plant manager by considering the market sales plan. The seed once processed and packed has validation up to 9 months if the seed is not sold it is brought back to the processing plant it is tested for its germination percentage as per the market specification of seed act, 1966 if it meets the requirements it is reprocessed and packed and it is valid for 6 months, the seed which is return from market and is subjected to reprocessing is called as bulk seed. Hence both type of seed i.e raw seed and bulk seed is processed in the plant. The Important operations in the seed conditioning plant can be explained under following heads:

- Issue and feeding of the raw seed
- Fine cleaning

- Destonning
- Specific gravity separations
- Treatment
- Packing

Issue and feeding of the raw seed/ Bulk seed

The raw seed which stored in gunny bags is bulked in the bulk bins by human labour just before day of processing. If it is bulk seed (sales return) then they have to be debagged earlier and have to under go germination test before they are to be issued. These bins are moved to the processing plant from ware house using fork lift. These bins are continuously feed one by one. Each bulk bins carries approximately 1.5 ton of raw seed. The seed is generally issued according to the lot size which are decide based on the crop, seed grower and location. The lots are issued one by one as they have to be processed separately.

Fine cleaning

The seed feed in to the feeder is moved to the fine cleaner bin by an elevator conveyor system. The seed is continuously feed to the fine cleaner through this bin, the feeding speed can be regulated through a gate provide at the bin. The fine cleaner has two screens the top screen and the bottom screen, the over sized particles are screened by the top screen the undersized particles are screened by the bottom screen. The fine cleaning operation improves the purity percent of the seed by removing foreign material, inert matter undersized seed, and weed seeds, off-size and deteriorated and damaged seeds. Almost 8-9 by volume of raw seed is lost in this process as unwanted rejected matter which is discarded from the production line. The recovery of good seed after this process is around 92% of the raw seed. Then the seed is sent through a conveyor and elevator system to feed in to Destonner.

Destonning

The fine cleaned seed is feed in to the destonner bin through conveyor elevator system. The bin continuously feeds the destonner the feeding speed can be regulated using the gate provide to th destonner bin. In this operation the heavy matter like stones and clods not removed in the fine cleaning are removed. The destonning operation is used for all crops except crop as it generally does not have stones or clods as they come as cobs to the plant and shelling is done in house in hygienic conditions. Fig: shows the different process used for the product line. During this process there is rejection loss of 1-2% of the total raw seed. The recovery % of seed after this process is around 90 % which varies from crop to crop and even hybrid to hybrid.

Specific gravity separations

The seed from destonner is delivered to the specific gravity separator bins through and elevator and conveyor system. The seed is continuously feed to two specific gravity machines through these bins the speed of feeding can be regulated as per the quality of the output seed. In this specific gravity the seed is separated from light and heavy particle, other crop seeds, weed seeds, damaged seeds, under weight seeds. The specific gravity works on the principle of gravity flow of seed which depends on the grain weight. The seed becomes totally uniform after this process. The loss at this stage is almost 5 % , so the total out put after this process is around 85% of the raw seed feed in to the fine cleaner. The seed after this process attains almost 98-99% purity depending on type of crop. The seed from the specific gravity is sent in to holding bins with huge capacities for storage before they are sent to the treatment chamber. The seed is stored in the holding separately by lot wise. The samples of seed are collected from the specific gravity and are subjected to the quality tests at in-house quality control lab. The seed is subjected to the purity test and moisture test at lab, if the seed meets the market specifications then it is sent to the treatment process. If the seed does not meet the market specifications then the seed from the holding bins is transferred to the bulk bin from which the seed is discarded or subjected to drying if moisture is high or subjected to reconditioning if purity is not attained.

Treatment

The pure seed in the holding bins after passing all the quality parameters is moved to the treatment chamber lot wise by closing one after the other gates of the holding bins, which are supported by conveyor and elevator system. The is treated with specified fungicides, pesticides, polymers and colorants as per the market specifications decided by the company which varies from crop to crop. The market specifications of each crop are provided in this chapter. The seed is treated in a continuous treator, which takes chemical from the chemical mixing tank in which the fluid is prepared by mixing water with all the required chemicals as per the market specification. The seed is continuously treated with the fluid and mixed in a chamber for uniformity. The treated seed is moved in to the treated seed collection bins from which the seed is sent to the packing bins by using Z- elevator. The samples of the treated seed are collected at frequent interval for quality check as per the market specifications. The moisture % and colour of the seed are the important parameter for quality that are checked for at this point. If the seed does not meet the market specifications then the seed is lot is stopped from packing. And it may be reconditioned or discarded.

Packing

Packing is done by using two automated machines and human labour. The primary pouches are packed indifferent pack sizes as per the market requirement, by using Nichrome packing machines. The machines are calibrated each time when the pack size is changed. There is a video jet printer provided at packing machine which prints the label details as per the seed act 1966. Each machine can pack 30 pouches / min. The pouches are collected through a conveyor belt. At this point of time the hologram stickers by using manual labour. The pouches are then moved to a common conveyor and collected by human labour in secondary bags which are generally High density polymer bags. Finally the secondary bag is rechecked for correct weighment and stiched along with a lab on stiching machine. The human labour are used to move the bags to the dispatch area.

II. METHODOLOGY

The methodology followed for conducting the study plays an important role in obtaining reliable results. The present study was conducted to understand the present production operations, identification of critical production operations, evaluation, optimization, and development of various resources allocated in the critical production operations of multi crop seed conditioning plant. The methodology includes sources of data, evaluation techniques used for analysis and limitations of the study.

Primary Data

1. The Primary data from the operator, workers and staff was collected using separate questionnaires, through survey method. The questionnaires are prepared to elicit responses of respondents in line with the objectives of the study.
2. The Primary data was also collected by observation method by using special formats designed for the purpose in line with the objectives of the study.
3. The Primary data was also collected by test runs conducted in the plant for the purpose of the study.

Secondary Data

The secondary data has been gathered from the past records maintained in the plant, company records, operating manuals in the company and various sites in the internet.

III. RESULTS AND DISCUSSIONS

MAPPING CRITICAL PATH FOR PRODUCTION IN THE MULTI CROP SEED CONDITIONING PLANT

From the observation method the activities in the plant have be classified in to primary and support activities as show primary activities are those which are involved in the main production line, and change or delay in these operations directly effect the productivity of the plant. The support activities are those activities which support the production process and which require less resources allocation than the primary activities. The primary activities identified are feeding, fine cleaning, destonening, specific gravity separation, treatment and packing. These activities fall in the main production line and are very critical for getting productivity in the plant. The support activities are drying , storage, issue of raw seed, quality testing, movement of seed by fork lift, plant malignance, housekeeping, inventory, health care, logistics, data entry. These support activities add to the primary operations to be done more effectively but not involved in the direct production process. The primary activities are continuous process unlike support activities which are taken for a short period of time as and when there is demand from the primary activities. Hence these primary activities are critical for increase production, profitability, and overall efficiency of the plant. (Table 1)

Table 1 Primary and support activities in the plant

Primary activities	Support activities
Feeding	Drying
	Storage (ware house)
Fine cleaning	Testing for germination & purity
	Issue of raw seed
Destonening	Movement of seed by fork lift
	Other Quality tests
Specific gravity separator	Plant Maintenance
	House keeping
Treatment	Logistics
	Health care
Packing	Inventory
	Data entry

Man machine relationship is very important in any production activity in a plant, effective machine requires effective human to have better outputs. The activities which have high man machine relations are identified they are feeding, fine cleaning, destonening, specific gravity, treatment chamber and packing. These activities in the plant are semi automated which requires a good pace of man machine relationship. So, these activities are critical for production.

EVALUATION, OPTIMIZATION AND DEVELOPMENT OF RESOURCE ALLOCATED IN THE CRITICAL PATH OF THE PRODUCTION

Resource in an organization can be divided in to following heads:

- Physical resources
- Human resources
- Information resources
- Financial resources

Financial resources is placed in center of all the resources which indicates that optimizations physical resources, human resources, and information resources, the outcome affects the financial resources of the organization. So it implies that financial resources cannot be separated from the other resources of organization so this resource is simultaneous evaluated along with other resources but not in separate.

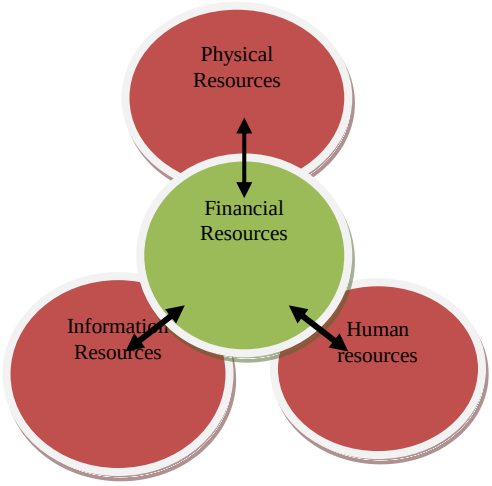

DIAGRAM 1

EVALUATION OF PHYSICAL RESOURCE

Physical resource used at present are calculated to being utilized at 48 % capacity of their installed capacities. So, there is good allocation of physical resource in the area of feeding, fine cleaning, destoning, specific gravity, treatment chamber and packing machine.

The feeding rate at the feeder is at the rate of 3 bins/hr by the fork lift. But the test run result conducted by fully dedicated fore lift for feeding has achieved the feeding rate at 10 bins/hr. The ideal feeding rate would be efficient at 5 bins/hr which match the requirements of the machinery in the line.

The major problem in conditioning is due to low purity percentage of the raw seed used for processing due to which the fine cleaner, destonner, specific gravity separators, have to be run at low capacities to attain the required purity percentage. This problem can be countered and efficiencies of other physical resources in the production line can be increased by installing pre cleaner. At present the Pre cleaner is not available in the processing line which can improve the seed quality by initial cleaning itself, removing unwanted materials in the production line. It is evident form the test run that low efficiency packing operation is badly effecting the production.

DEVELOPMENT OF PHYSICAL RESOURCE

The physical resource can be developed by addition of a pre cleaner machine to the processing activity. This improvement in the physical resource will develop the efficiency of all other machinery as it reduce the burden on fine cleaner, destonner, and specific gravity, and enhance there operating capacities.

There should be a one dedicated fork lift for both the plants provided for feeding the seed to the feeder, unlike the present which is involved in all other activities like helping in loading and unloading activities of logistics, movement of seed with in ware house.

EVALUATION OF HUMAN RESOURCE

The following the allocation of human resource in different production operations. It is evident from the data that 69 % of total human resource is allocated to packing operation. So, packing operation is critical for the human resource.

The job analysis of the operators are of two kinds first kind is the conditioning operator who looks after all the conditioning operations line feeding, operating fine cleaner, operating the destonenor, operating the specific gravity and treatment chamber. The second kind is the packing operators who operate the primary packing machine, looks after the printing of labels, feeding the packing materials to the machine.

The results of interview show that 100% of packing operators and 100 % of conditioning operators feels that they require high skill as there is very high variation in their job. Further it shows that 60 % of conditioning operators feel that they have to perform different operations most regularly, this is one reason for there low learning curve.80 % of packing operators feel they rarely attend any operation apart from packing.

The survey showed that 100 % of the packing operators are technically qualified but on other hand 100 % the conditioning operators are not technically qualified. As whole the operators of the processing operation in the plant come to be only 65 % are technically qualified.

The present turnover rate of packing operators, conditioning operators and total operators in the plant was calculated to be 37.5% .

The hygiene factors and motivational factor for the work were evaluated for packing operators and the conditioning operators in the plant. The results show that the hygiene factors like pay to packing operators is satisfactory, the working conditions are good, and safety at work is very good, and the relations with superiors is good. From the table it is also evident that 100 % of the packing operators fell that there is no any motivational factor for them.

The hygiene factors and motivational factor for the work were evaluated for conditioning operators and the conditioning operators in the plant. The following table shows the result of evaluation of the packing operator in the plant. The results show that the hygiene factors like pay to conditioning operators is poor, the working conditions are good, and safety at work is very good, and the relations with superiors is good. From the table it is also evident that 100 % of the conditioning operators fell that there is no any motivational factor for them.

DEVELOPMENT OF HUMAN RESOURCE

The results of interview method show that 80 % of packing operators and 100 % of the conditioning operators have been trained on job. Only 20% of packing operators have trained by professionals from the packing machine company. So, training is very important for development. 100% operators feel that they require new training to develop there skills in operating and enhance productivity once year. They also feel that operator's camp has to be conducted during the off seasons of plant to share the observations and experience with all other operators. This also increases the experience curve in short duration. All the operators feel that there is no evaluation procedure for appraisal of performance of operator and motivations factors like variable payment for good performance, recognition, growth and advancement which are very important to enhance the productivity, performance and reduction of the human resources.

EVALUATION OF INFORMATION RESOURCE

At present there is good enterprise resource planning systems are being used in the plant but these are only used at the management level, and there is no access for the operator who are directly involved in the production process. At present the information regarding the output schedule is given to the operators by writing on the board provided for it. But it provides information only regarding what product to take up, how much to process but it does not provide the details about the progress of the operations. That is how much is conditioned, still how much to conditioned or how much has been packed and still how much is to be packed. In the interview conducted for the operator 95 % of operators feel that they do not know the production schedule exactly.

The data collection systems are well established in the plant like recording of down times, recording of problems encountered during operations, which have to be repaired by the maintenance department. But there is no proper follow up for this activity on time basis it is recorded after the end of the shift.

The 90% of operators feel that communication in the plant is two ways that is management to operators and operators to management which is good sign for healthy working conditions.

There is no information system to record the experience of conducting an operation and constant improvement of the same.

DEVELOPMENT OF INFORMATION RESOURCE

The experience curve is very important for any organization which involves high skill involved activities, the turnover rate of operators in the production operations is high, so the information system should be developed to record the experience of operating the machinery in the plant. This information retains at plant even if the human resource turnover rate is high. This can be done self learning camps during the off season, and awarding the best operator for identification and teaching best method of operating the machine to enhance the production efficiency. These methods have to be recorded and stored as information resource of the organization.

IV. CONCLUSION

To conclude the activities which have high man machine relations are identified as feeding, fine cleaning, destonening, specific gravity, treatment chamber and packing. These activities in the plant are semi automated which requires a good pace of man machine relationship. So, these activities are critical for production. Physical resource used at present are calculated to being utilized at 48 % capacity of their installed capacities. To enhance the production efficiency few physical resources should be added like pre cleaner machine to the processing activity and a full time fork lift at feeding. Operators feel that they require new training to develop their skills in operating and enhance productivity once year, operator's camp has to be conducted during the off seasons of plant to share the observations and experience with all other operators to increases the experience curve in short duration. All the operators feel that there is no evaluation procedure for appraisal of performance of operator and motivations factors like variable payment for good performance, recognition, growth and advancement which are very important to enhance the productivity, performance and reduction of the human resources. At present enterprise resource planning systems are being used in the plant used at the management level only, and there is no access for the operator who are directly involved in the production process. The experience curve is very important for any organization which involves high skill involved activities, the turnover rate of operators in the production operations is high, so the information system should be developed to record the experience of operating the machinery in the plant. The physical , human, information resources should be developed for efficient utilization of financial resources of the plant.

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