

PACKAGE OF PRACTICES

Post Harvest Technology Centre, Bapatla

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The farmer, in a remuneration point of view, must attend to certain primary processing operations like threshing, winnowing, cleaning, drying, grading, polishing, milling etc. There is a need to adopt appropriate post harvest technologies for cost, time and labour saving towards *enhancement* of quality and marketability to the produce by value addition and by-products utilization. Primary processing by farmers can potentially get more remunerative price and profits by increasing quality by value addition and efficient utilization of by products besides reducing post harvest losses.

1. Threshing of Paddy by power thresher:

Power threshers are recommended for threshing paddy crop due to its multiple advantages like low investment, high threshing efficiency, low operational cost compared to traditional tractor threshing. It has additional advantages of simultaneous winnowing and cleaning, besides threshing. Under-utilization of tractor of 35 hp power can be avoided, as the job of threshing to the same extent could be achieved by expending only 7-10 hp, in case of power thresher. About 5-6 litres of diesel could be saved, besides increased output of 1-2 bags of paddy which otherwise goes as threshing loss in case of tractor threshing. Under-utilisation of 35 hp tractor for a 10 hp, job of threshing, if avoided would go a long way in saving fuel energy and foreign exchange.

2. Threshing benches:

Threshing benches either with wire mesh top or with perforated M.S. Sheet may be used in place of wooden benches for threshing the paddy crop as they are more efficient and have more service life. Four men can thresh about 25 bags of paddy in a day. Each threshing bench costs about Rs. 600/-. The process is particularly advisable when paddy is collected for seed purpose.

3. Winnowing machines for grain cleaning:

Hand and power operated (Power tiller, tractor or small engine operated) winnower can separate chaff, dust etc. from grain. About 500-800 kg of grain can be winnowed in one hour. These machinery are useful when sufficient winds (velocity) are not available and during unfavourable weather conditions.

4. Husk fired furnace dryer for drying of paddy:

A half ton capacity husk fired furnace type batch dryer developed at this centre can dry paddy from 25% moisture content to 13% moisture content in a matter of 4-5h. It is much useful when sun drying is not practicable in inclement weather during rainy season and under sudden cyclone threat conditions.

5. Agricultural waste fired chilli dryer and its utilisation as multipurpose dryer to dry other crops:

A two quintal capacity chilli dryer designed and developed at this centre can dry ripe chillies from 70% moisture content to 15% moisture content in 24 hours compared to 12-15 days in open yard sun drying. The chillies dried by this dryer retained colour for a longer time during storage compared to sun dried produce and are dust-free with high quality and appearance. Drying can be done from the crop residue or paddy husk. This dryer could be used as multipurpose dryer for drying other crops like turmeric, groundnut and coconut.

a) Drying of turmeric:

Drying of turmeric using Agricultural waste fired dryer is advantageous in time and cost saving. The results showed 65.47% of time saving and 7.8% of cost saving compared to traditional method of sun drying. It took 58 hours to dry turmeric of 79.24% moisture content to 12.5% level against 168 hours of time taken for the similar level of drying in open yard drying.

b) Drying of groundnut:

The Agricultural waste fired dryer was also evaluated for drying groundnut. When dried at 40-43° C it took 25 hours compared to 4 - 5 days required in open yard sun drying for bringing down the moisture content from 28% to 8%. There was no adverse effect on germination of the seed after drying by the dryer.

6.a) Mini Dhal Mill:

The mini dhal mill plant was developed with suitable accessories and attachments like drying cum storage bin with husk fired heat exchanger system, sieve set, mixer for pre-treatment with oil and water, thus mechanising all the processing operations involved in dhal making. It will separate dehusked wholes. It can run with a 3 h.p motor and can mill 150 to 160 kg of blackgram per hour with 65% to 70% wholes and 15% to 18% splits recovery, thus about 80%-82% dhal was recovered compared to only 70-75% in traditional method.

b) TNAU-Power operated mini dhal mill:

The mini-dhal mill was tested. It is capable of splitting 30 kg of blackgram per hour with a recovery of 83.5% split half grains with 12% of broken. In respect to greengram, it can mill 32 kg/h. with recovery of 80% splits and 17% broken.

7. Power operated turmeric polisher:

With suitable alterations and further attachments like 2 h.p motor, V-belt and chain drive mechanism and gear system, the hand operated turmeric polisher was converted into

power operated turmeric polisher. It can run at 30-32 rpm. The power operated ANGRAU Turmeric polisher can polish about 600-700 kg of turmeric in an hour with 98% polishing efficiency.

8. ANGRAU Turmeric Grader:

The ANGRAU turmeric grader designed and developed by this centre can grade about 400 kg of turmeric in an hour into four fractions namely bulbs, fingers (3 cm length and above), Polishable Nali (2 to 3 cm length) and un-polishable Nali (less than 2 cm length) in a single pass, thus eliminates tedious and laborious manual grading. This also facilitates better quality and value addition to get higher remunerative price.

9. Batch type rice bran stabilizer suitable for stabilization of rice bran:

Stabilization of rice bran with rice bran stabilizer at 100° C for 10 minutes controls the increase in free fatty acid up to 28 days in storage, by inactivation of lipase enzyme. This facilitates extraction of edible grade oil, thus helps in better utilization of rice bran, the by-product of rice milling industry.

10. Chilli Seed extractor:

The TNAU chilli seed extractor was found to operate at 46-50 kg/hr capacity which is particularly suitable for extracting seed from smaller lots without intermittent cleaning. PKV chilli seed extractor was found to be effective to obtain clean seed i.e., free from broken pericarp and dust. The capacity of the extracting machine is around 100 kg/hr. The extraction efficiency for both the equipment is in the range of 96 to 99%. The high capacity extractor is useful for seed producers and large farmers.

11. Mango Harvester:

Experiments using IIHR mango harvester gave a harvesting capacity of 170-200 kg mangos/hr (500-550 fruits/hr). It was observed that farmers are using a dhoti which is made locally using bamboo stick and net made of jute thread. The net is connected to the curved frame. Local dhoti gave a capacity of about 300-350 fruits/hr. Percentage dropped fruits while harvesting were found to be lower 8-10% compared to 20-25% in local dhoti thereby reducing the damage to the fruits. However the IIHR mango harvester is somewhat heavy and difficult to handle for harvesting fruits by standing on the tree particularly for old and well branched trees. Two types of Mango harvesters which are useful to harvest fruits from ground (for small trees / young gardens) and on the tree (for old and well branched trees) as alternatives to local harvester have been designed, fabricated and tested with Banginapalli variety. The light weight harvester when used on large, well branched trees gave a harvesting capacity of 625-650 fruits per hour. The heavy weight model useful to harvest fruits from ground gave a capacity of 600-615 fruits per hour. Local dhoti gave a capacity of 300-350 fruits / h.

12. Survey of rice milling in Andhara Pradesh :

A survey of rice milling system was conducted in Andhra Pradesh and the data collected in the form of a questionnaire. The grain factors that affect the percentage of broken include moisture content, variety, type of soil and time of harvest. The machine factors that affect include the condition of the rubber rollers, speed and wear and tear in sheller and gap between cone and concave, life of rubber packing and wear of emery cone in the polisher. Out turn of rice from paddy after milling differs from sample to sample and type of milling system. Breakage of rice invariably originates from cracked, immature and other damaged grains. The corrective measures suggested to reduce broken percentage of rice are; harvest the paddy at optimum moisture content, thresh the paddy by mechanical thresher, dry the paddy uniformly in steps by maintaining tempering periods, modern rice mills with rubber roll shellers are recommended for minimum broken percentage of rice, to maintain the rice mill timely replacement of rubber rolls, and timely replacement of cone in the cone polisher. Maintaining proper gap between the cone and the rubber brake in the cone polisher is critical to reduce broken in rice milling.

13. Conversion of tobacco barns for chilli drying

Ten to twelve quintals of ripe chillies can be loaded in the existing tobacco barns to dry chillies. G.I. wire mesh trays of size 105 x 75 x 7.5 cm are suitable to hold chillies on the existing tiers. Each tray can be loaded with 7 to 8 kg of ripe pods. Drying time required to reduce moisture from 75 to 10% (w.b.) vary considerably depending upon whether the chilli is hybrid with thick pericarp (eg. Wonder hot) or varieties with medium to thin pericarp (eg. LCA 334). The former takes about 50 hours to dry whereas the latter type takes about 40 hours only. The temperatures ranging from 50°C to 55°C are appropriate for drying chillies. The open yard sun drying takes 12 to 15 days in comparison to barn drying method. The cost of barn drying is approximately Rs.1.50-2.00 per quintal of dry chilli. The percentage discoloured pods can be reduced to about 3.5 to 4% in barn dried produce in comparison to 9-10% in open yard sun drying. The barn drying method has the advantages such as; 1) quality product with good colour retention and free from external contamination 2) less number of discoloured pods (Talukaya) 3) Reduction in drying time 4) Drying can be accomplished even during inclement weather particularly early in the chilli season i.e., November to February to fetch remunerative price.

14. Drying of chillies in a poly house:

ANGRAU poly house solar dryer of size 12 x 7.8 x 2.1m has been developed to dry about 20 quintals of ripe pods. The dryer essentially consists of an arch type poly house to hold chillies on two different tiers made of wire mesh fixed to frame assembled by nuts and bolts. The whole frame structure is covered with a UV stabilized 150 gsm cross laminated semi-transparent polyethylene sheet with ventilators at bottom and top to facilitate movement of air. The drying time is 5 to 8 days to reduce moisture from 75% to 10% (wb) in comparison to 15 to 20 days required to dry chilli in open yard sun drying. The dryer can be converted into nursery house by replacing poly sheet cover using 50% shade net. About 70,000 chilli seedlings can be raised in the house per batch. The poly house can also be used to raise green Coriander during off season i.e. in May and June when the chilli drying is

completed. The poly house can be efficiently used for about 10 months in a year in chilli growing region i.e. Drying of chillies during December to April, Coriander leaf production in May to June, raising Chilli nursery during July to September.

15. Performance of Sonalika thresher for Bengal gram :

The performance evaluation of Sonalika thresher for Bengalgram was evaluated at Chandulur and Dronadula villages of Prakasam district. It was observed that it can thresh about one to one and half acres of Bengalgram crop in one hour. It was also found that the output of the thresher was 10 to 12 quintals of Bengalgram in one hour. The threshing capacity depends upon the crop variety and its yield. The average efficiency of the thresher was found to be 98.33%. Cost of operation was about Rs. 500/- per hour which includes labour and diesel.

16. Safe Storage of groundnut:

a) Drying and storage structures:

Groundnut has to be dried to less than 9% moisture for safe storage which can be stored upto 6 months without aflatoxin contamination and loss of viability. The groundnut can be stored better in 1) loosely knitted gunny bags 2) compactly knitted gunny bags, 3) nylon bags and 4) polythene lined gunny bags.

b) Viability of groundnut in storage:

TMV-2 variety of groundnut maintained high viability (83%) with lesser fungal growth (16%) at 240 days of storage while the viability was least in K-150 (24%) followed by K-3 (21.6%) indicating their unsuitability for storage as seed. The viability was 79% in K-1186, 73% in K-153 and 67% in K-1143 at 180 days of storage. However the viability of these varieties drastically fell below 35% level by 240 days of storage.

17. Safe storage of pulses:

Pulses can be safely stored in nylon bags, polythene lined gunny bags for 6 months provided the grain is properly dried before storage. Mixing of 250g of edible oil per quintal of pulses is beneficial for safe storage.

18. Chilli storage:

Chillies stored in amber coloured polythene bags were found to retain colour for longer period of storage. Mechanically dried chillies showed higher colour value in chillies during storage than that of open yard sun dried produce.

19. Biochemical changes in paddy during storage:

Paddy stored upto 10-12 months was found to improve its quality without change in their milling and culinary properties. However, beyond 18 months of storage, there is deterioration in its milling and culinary properties.

20. Use of plant origin materials for safe storage of pulses:

Among the different plant origin materials and inert materials tried against pulse beetle *C.maculatus* infestation in stored pulses, Neem oil at 0.25% or 0.5% level of mixing with the pulse grain was found to be the best in preventing the damage of stored pulse up to 195 days of storage. Mixing of vegetable oils at 0.25% or 0.5% also protected the pulses from damage by pulse beetle up to 300 days of storage.

21. Curcumin content in stored turmeric varieties:

The Curcumin content in stored turmeric varieties progressively decreased with length of storage period. Among the varieties tested the decrease in Curcumin content in storage was higher with Mydukur followed by PCT-14 and TC-2.

22. Chemical treatment of copra to prevent fungal damage:

Mature coconut halves treated with solutions of 1% acetic acid, sodium bicarbonate or sodium chloride protected the copra from spoilage due to fungal infection.

23. Suitability of storage containers for storage of tamarind:

Tamarind gained moisture when stored in mud pots and gunny bags with reduced total acidity compared to the produce stored in polythene bag, tetrapack or glass bottle. The acidity of the samples stored in tetra pack was highest followed by polythene bags, whereas it was least in case of the samples stored in gunny bags followed by mud pots. None of the structures however could prevent discolouration of stored tamarind as it is temperature dependent.

24. Use of Maize stalks for oyster and milky Mushroom Cultivation

Maize stalks after harvest of the cobs can be utilized for the cultivation of oyster and milky mushrooms in place of paddy straw. Yield and bio-efficiency of the mushrooms cultivated by using maize stalks will be on par with mushroom yield cultivated with paddy straw.

25. Paddy dryer for on farm drying of Paddy.

A 5 T capacity Paddy dryer is made available in Post Harvest Technology Centre, Bapatla for farmers use for on- farm drying of machine harvested paddy. A trial run was made at Appikatla farmers field with 5T of paddy (Var: BPT 5204) and the following observations are recorded. Some more trials are required for conforming the above given results.

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| i. Fuel consumption for burner: | 12 l/ Batch of 5 tonnes |
| ii. Labour required: | 4 No's |
| iii. Duration of Drying at drying air temperature of 50 ⁰ C: | 6 h |
| iv. Duration of curing: | 2 h |
| v. Power supply: | 3 phase A.C. current |
| vi. IMC: | 22-24 % (db) |
| vii. FMC: | 11-12 % (db) |

26. Fuel Briquetting machine:

- a) Fuel Briquetting machine is tested for its performance evaluation. Locally available crop residues such as paddy husk, maize, chilly stacks, groundnut shells and Bengalgram stacks etc are being used as raw material for making the briquettes. The Engineering properties like Bulk density, calorific value, ash content, moisture content of these raw materials before and after briquetting were determined. Briquettes made with rice husk, groundnut shells, chilly stacks, maize stacks burned for long duration and can be used in agro dryers to reduce operating cost and to save conventional fuel. Economics of fuel briquetting machine is studied. Unit cost: Rs. 4.15 / Kg. Some more trials are required for conforming the above given results.

Addresses and contact phone numbers of Post Harvest & Agricultural Equipment suppliers.

S.No.	Address	Phone No.
1.	The Manager (Implements) AP Agro Industries Development Corporation Agro Bhavan, 10-2-3, A.C. Guards, Hyderabad-500 004	040 - 23396530 23317225
2.	M/s Viswakarma Engineering Company Plot No.138, Road No.26 Industrial Estate, Kattedan, Hyderabad – 500 077	040-24361719
3.	M/s Karshak & Sons Shop No.42, Al Karim Trade Centre M.G. Road, Secunderabad – 500 003	040-27542315
4.	M/s Mekins Agro Products Pvt. Ltd. Plot No.30, IDA, Gandhinagar, Balangar, Hyderabad-500 037	040-23085959
5.	M/s Escorts Tractors 160/1, Sardar Patel Road Opp. Global Trust Bank Secunderabad	040-27907073
6.	M/s Farm Implements (India) Pvt. Ltd., 10, Kumarappa Street, Nungamakkam, Chennai – 600 034	044-28261676
7.	M/s Farm Steel Products PD 17 & 18, Industrial Estate Vijayawada – 520 007	0866-2472694 (R) 2553958 (O)
8.	M/s Jai Bharathi Engineering Works Plot No. C-25, Industrial Estate Machilipatnam Road, Gudivada – 521 301	08674 – 243392
9.	M/s Modern Arc Welding Works 16-256, Venkateswara Theatre Road Gudivada – 521 301	08674- 242029 (O) 246505 (R)
10.	M/s Riteset Industries Gudivada – 521 301	08674-243918 (O) 243997 (O) 243626 (R)

11.	M/s Siri Enterprises Plot No.38, Phase – III Indira Autonagar Guntur – 500 001	0863–2211444 (O) 2556678 (R) 2556319 (R) 9440471202
12.	M/s Sri Adhivishnu Machine Tool Stores Old Bus Stand, Morrispet Tenali – 522 202	08644-223320 (O) 228711 (R)
13.	M/s Sri Srinivasa Auto Engineering Works Industrial Estate, Plot No.C2 & C3, Gudivada	08674 – 242862 242374
14.	M/s Navya Industries, Plot No.A-3 Auto Nagar Gudivada – 521 301	08674 – 244597 245482 98666 31866
15.	M/s A.P Agros industries development corporation 504, Heritage complex, Hill ford road, Hyderabad-4 A.P. Agros industries development corporation workshop complex, Narasapur Road, Balanagar, Hyderabad.	040-23391331, 23314246, 23317225.
16.	M/s Methasis Engineers Pvt. Ltd Plot No. B-35, B.H.E.L – A.I.E, Ramachandrapuram, Hyderabad -3	040- 23020628, 23022298, 23730134.