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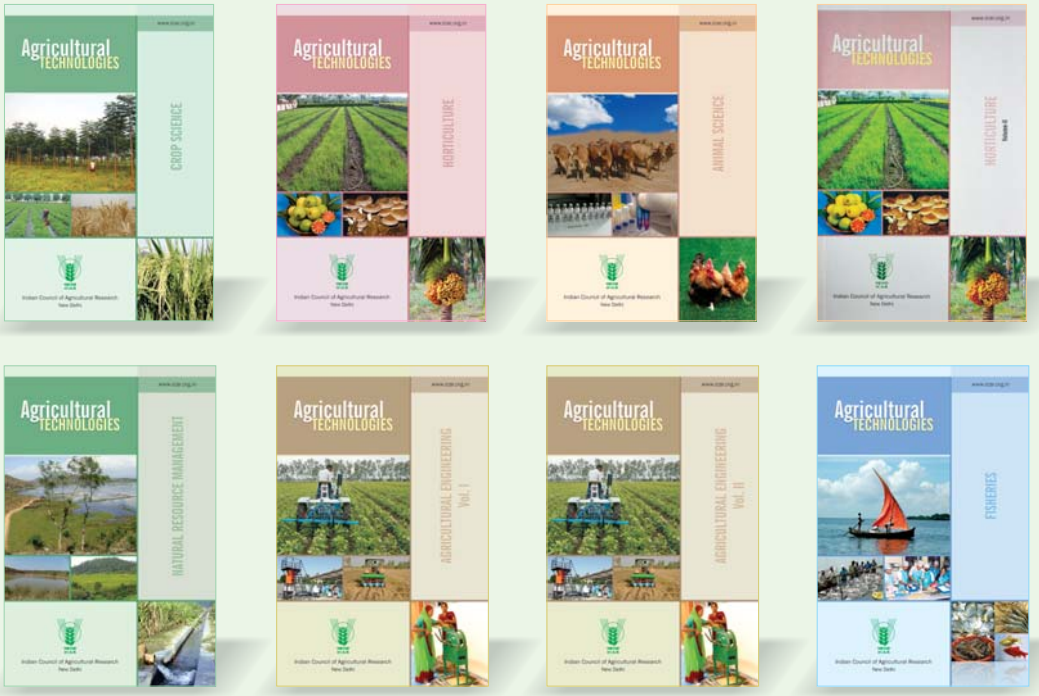

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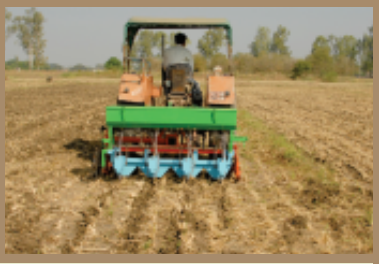
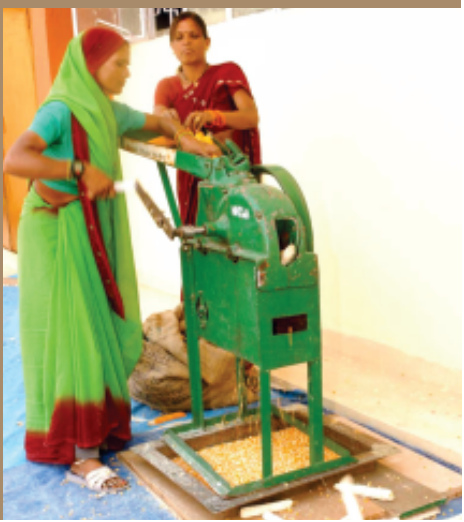
Agricultural TECHNOLOGIES

AGRICULTURAL ENGINEERING
Vol. II





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ICAR

Indian Council of Agricultural Research
New Delhi

Agricultural Technologies Ready for Commercialization

AGRICULTURAL ENGINEERING

Vol. II

Indian Council of Agricultural Research
New Delhi

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The cost mentioned for each technology in the publication is only indicative and suggestive as the technologies were developed in different base years and locations.

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शरद पवार
SHARAD PAWAR

कृषि एवं खाद्य प्रसंस्करण उद्योग मंत्री
भारत सरकार
MINISTER OF AGRICULTURE &
FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

Message

Indian agriculture has overcome several challenges in the past and achieved phenomenal success ensuring self-sufficiency in food production. The technologies generated within the National Agricultural Research System (NARS) have significantly contributed to the transformation of Indian agriculture and ushering Rainbow Revolution representing Green, White, Golden, Brown and Blue revolutions defining outstanding technology-led performance in foodgrain, milk, oilseeds and pulses, horticulture and fisheries sectors. Agriculture along with other primary sectors is a major source of strength for the Indian economy. However, burgeoning population, increasing demand for food, feed and fodder, decreasing land availability, natural resource degradation, decreasing factor productivity, climate change, slow growth in farm income and new global trade regulations have put new challenges threatening food, nutritional and livelihood security.

Technological interventions by the NARS have led to spectacular accomplishments relating to input use efficiency, climate resilience, mechanization and secondary agriculture leading to economic transformation. These coupled with the application of information and communication technology will play a critical role in our future endeavours to accelerate agricultural growth in the country. I am glad that the Subject Matter Divisions of Indian Council of Agricultural Research (ICAR) have synthesized and compiled practical and useful technologies in this series of publications on Agricultural Technologies in a user-friendly mode. I am sure this information will be useful to farming community, extension agencies, entrepreneurs and agro-industries in their efforts to make Indian agriculture economically viable and ecologically secure.

January 2014
New Delhi

(Sharad Pawar)

Foreword

Agriculture is the corner-stone of Indian economy. About 70% of India's 1.27 billion population live in rural areas with small and marginal land holdings. India with a geographical area of over 328 million hectares is endowed with diversity of climate, soils and vegetation. This rich resource endowment is, however, threatened with ever increasing population, vagaries of nature and climate change. The National Agricultural Research System (NARS) comprising the Indian Council of Agricultural Research (ICAR), 55 State Agricultural Universities, five Deemed Universities, four Central Universities with agriculture faculty, one Central Agricultural University and 637 Krishi Vigyan Kendras have attained excellence in several frontier areas of agricultural sciences and technology contributing significantly towards the spectacular growth of Indian agriculture during past 60 years.

Initiatives by NARS in the country have led to notable accomplishments resulting in the socio-economic transformation of farmers. The agriculture sector is, however, witnessing radical changes and challenges both at national and global level. The emerging challenges and opportunities necessitate wider and faster adoption of the improved technologies by all the stakeholders right from production to consumption in a food chain. In an effort to achieve this, the divisions of crop science, horticulture, animal science, natural resources management, fisheries and agricultural engineering in the ICAR have compiled the technologies already commercialized and the technologies ready for commercialization. This series of publications, brings out the salient features of the technologies with details on potential users and contact details of the developers for ready and easy access. It will be our endeavour to periodically update this Technology Series. I hope that this publication would be useful to the farming community, extension agencies, entrepreneurs and industry. I greatly appreciate the efforts put in by my colleagues in the Council, research institutes and State Agricultural Universities (SAUs) in bringing out this compilation.

(S Ayyappan)
Secretary,
Department of Agricultural Research and Education, and
Director General
Indian Council of Agricultural Research
New Delhi

January 2014
New Delhi

Preface

The agricultural engineering division of ICAR is primarily involved in the areas of farm mechanization, precision farming, energy in agriculture, post-harvest management and value addition of agricultural, livestock and aquatic produce. The technologies developed by the institutes and the AICRPs are disseminated to the stakeholders through various channels. Transfer of technology to the farmers and the entrepreneurs has always remained a challenge. Engineering interventions in agriculture have become imperative to improve productivity, reduce the cost of production and drudgery, and improve livelihood opportunities. Farm mechanization for timeliness of operations, precision farming for improved input use efficiency, processing technologies for value addition and reduction in post-harvest losses, conservation of natural resources and energy management are the core areas. Technologies have been developed and commercialized in these areas.

Over the years, the network of institutions have been strengthened, but it still cannot reach the vast majority of stakeholders. The Engineering Division of ICAR has compiled two publications in the form of compendium of "Agricultural Engineering Technologies – Commercialised" and "Agricultural Engineering Technologies – Ready for Commercialisation". The publications have been subdivided into sections on Seed Bed Preparation, Seeding and Planting, weeding and Plant Protection, Harvesting, Threshing, Post-Harvest Equipment, Value-Added Products, Irrigation and Renewable Energy and Miscellaneous Technologies to easily locate the relevant technologies. The salient features, performance results, cost (the cost is indicative depending on the place and year of development) impact and benefits, address of manufacturers and the institute where it has been developed have been included for each technology. I am confident that this publication will be useful to all the stakeholders involved in agriculture including extension personnel and entrepreneurs. I appreciate the efforts put in by my colleauges Dr K K Singh, ADG (PE), Dr K K Singh ADG (Engg.), Dr S Genesan, Dr Devinder Dhingra, Dr K P Singh, Dr K N Aggarwal, Dr Nilesh Gaikwad and Ms Monika Sharma in compilation of this document.

Dr D Rama Rao
National Director, NAIP, ICAR,
New Delhi

CONTENT

Animal Drawn Stubble Collector

Salient features

- Stubble collector consists of a frame, collecting rake, handle, hitch and beam.
- It is used for collecting stubbles, weed residue and crop residues in harvested fields.
- The main component is the rake which consists of curved mild steel rods.
- The bars are sharpened and curved up to a height of 75 mm from bottom.
- During stubble collection, the implement also breaks soil clods.
- Overall dimensions (w×h) : 1,650×360 mm
- Weight : 33 kg

Performance

- Depth of operation : 55-60 mm
- Forward speed : 2.95 km/h
- Field capacity : 0.42 ha/h
- Draft : 500-600 N

Cost

- Unit cost : ₹ 2,500
- Cost of operation : ₹ 350 /ha

Impact and benefits

- There is 80% saving in cost of operation using this implement.

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Engine Operated Portable Post-Hole Digger

Salient features

- Helix : Partially double, Diameter : 150 mm-Thickness: 5 mm
- Cutting edge length :70 mm, Width : 4 mm, Thickness: 10 mm
- Power transmission system: Gear system with 11:1 speed ratio (110-160 rev/min)
- It consists of 3.73 kW diesel engine, mounted on 4 wheel trolley.

Performance

- This machine makes about 25 to 35 pits of 150 mm diameter and 450 mm depth per hour.

Cost

- Unit cost : ₹ 60,000
- Cost of operation : ₹ 10/pit

Impact and benefits

- This machine is useful for creating pits on uneven field or forest area users.
- Socio-economic conditions of farmers can be strengthened by portable post-hole digger.

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Power Operated Nursery Media Filling Machine

Salient features

- The unit consists of 2.2 kW motor, feed hopper, paddles, sieving tray and electronic vending.
- Electronic vending is the novel system adopted in this machine, which is used for filling the nursery media mixture at set quantity (250 g, 500 g, 1,000 g, etc.).
- Accuracy of the system is more than 90%, which is the acceptable level in nursery practices.
- Two women operators are required, and both the operators can safely and comfortably work with the machine in standing and sitting position.

Performance

- Capacity : 100 kg /h

Cost

- Unit cost : ₹ 1,00,000

Impact and benefits

- Saving in cost and time over conventional method are 71.4% and 80.2% respectively.
- Reduction in drudgery of operation as compared to manual method.

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Tractor Operated Plastic Mulch Laying Machine

Salient features

- The equipment consists of concave discs of 400 mm diameter for making bunds or raised beds.
- Pneumatic press wheels of 350 mm diameter for pressing the edges of plastic film to the ground.

- Overall dimensions (l×w×h) : 1,850×2,600×1,550 mm
- Weight : 400 kg
- Length of roll holder : 1,950 mm
- Diameter of roll holders : 75 mm
- Diameter of concave disc : 400 mm
- Speed of operation : 0.39-0.49 m/s

Performance

- Field efficiency : 55.4-62.5 %
- Field capacity : 0.12 – 0.18 ha/h

Cost

- Unit cost : ₹ 55,000
- Cost of operation : ₹ 2,000-2,200/ha
- Labour requirement : 15 man-h/ha

Impact and benefits

- Saves 41% water and 71% labour in weeding over raised beds.
- About 30 % higher yield in raised beds with plastic mulch over bare raised beds.
- User can earn benefit of ₹ 21,000/ha.

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Animal Drawn Zero Till Seed-cum-Fertilizer Drill

Salient features

- It is available in 3 sizes (1/2/3 rows) and may be selected depending on pulling capacity of work animals.
- It consists of inverted 'T' type furrow openers.
- Weight of the machine is 40-60 kg and draft requirements vary between 400 and 600 N.

Performance

- Field capacity : 0.02-0.06 ha/h

Cost

- Unit cost : ₹ 3,000- 4,000
- Cost of operation : ₹ 700-1,800/ha

Impact and benefits

- Saving in cost of operation by ₹ 1,200-2,300/ha.
- Saving of time 60-85 h/ha.
- Increased yield by 4-5% because of timeliness in seeding.
- Owing to minimum disturbance of soil in zero tillage, this implement will be able to prevent soil erosion, a major problem in hill region.

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Animal Drawn Potato Planter

Salient features

- Type : Single row, animal drawn, automatic metering
- Dimension (l×w×h) : 1,550×1,100×1,150 mm
- Weight : 110 kg
- Tuber to tuber spacing : Adjustable (160 to 300 mm)
- Metering mechanism : Picker wheel

Performance

- Field capacity : 0.9 ha/day
- Tuber missing : Negligible
- Tuber damage : Less than 0.5%
- Power requirement : A pair of bullocks
- Labour requirement : One person

Cost

- Unit cost : ₹ 9,000

Impact and benefits

- Increased work output.
- Uniform row to row and plant to plant spacing.
- Saving in time and labour.
- The developed prototype shall promote the use of animals in potato cultivation for small and marginal farmers.

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Animal drawn Single-row Inclined Plate Planter

Salient features

- Suitable for sowing of crops like groundnut, maize, pigeonpea, mustard, gram and soybean.
- The planter is provided with a seed box with inclined plate type seed metering mechanism.
- Shoe type furrow opener ensures low draft requirement of the machine.
- Seed plates can easily be changed for sowing different crops.

Performance

- Field efficiency : 80-85%
- Field capacity : 0.05-0.1 ha/h

Cost

- Cost : ₹ 2,500
- Cost of operation : ₹ 800-1,000/ha

Impact and benefits

- Use of planter would result in saving of seed up to 20%.
- Use of planter would also result in increase in productivity up to 20% due to uniform and accurate placement of seeds.
- Reduced time of operation and drudgery.

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Pneumatic Operated Sugarcane Bud Chipper

Salient features

- It consists of frame, bud chipper to chip the buds and an air compressor with a pneumatic cylinder.
- The blade is attached to a stainless steel cylindrical shaft, which is operated by pneumatic cylinder.
- The pressure required to chip the buds varies from 0.60 to 0.70 MPa.

Performance

- Capacity : 1,000 bud chips/h

Cost

- Unit cost : ₹ 30,000

Impact and benefits

- Removing of sugarcane bud chip from sugarcane for planting in nursery.
- The excess sugarcane can be taken to factory for juice extraction.
- Easy storage and transportation of sugarcane bud chips.

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Power Operated Seed Pelletizing Machine

Salient features

- Overall dimensions (l×w×h) : 1,400×1,000×600 mm
- Electric power : 3 kW, single phase motor
- Manpower : 1 person
- It consists of hemispherical coating pan rotated in an inclined plane with the help of motor and gear box.
- Cleaned and graded seed fed to the pan, rotation on inside surface of the pan and coating slurry is sprayed intermittently on to the seed by hand pump, drying them simultaneously by hot air supplied through a blower.

Performance

- Capacity : 250-500 g/batch/three hour
- Size of pellets : 3 to 5 mm diameter (as per requirement)

Cost

- Unit cost : ₹ 85,000

Impact and benefits

- Maintains the quality of seeds.
- Various treatments to seeds can be done.
- It may be helpful in reducing the germination period of seeds and increase germination percentage.

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Tractor Operated Seed Drill for Sowing on Furrow Slants

Salient features

- A tractor operated three furrows, multi-crop seed-cum-fertilizer drill with a seed pressing device.
- Specifically designed for seeds to be sown on the slant surfaces of the furrow.

Cost

- Unit cost : ₹ 35,000-40,000

Impact and benefits

- Prevents crust formation.
- Increase in crop production (30-70%).
- Deep and wide furrows created help in moisture retention and check soil erosion.
- Facilitates application of drip irrigation system more conveniently and effectively.

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