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Advancements in Mechanized Techniques for Sweet Corn Cultivation: A Review

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This introduction on sweet corn includes a detailed account of its history, cultivation, and accompanying technologies. Sweet corn, a variety of field corn (*Zea mays*) with a genetic mutation that results in greater sugar content in its kernels, was initially grown in Pennsylvania in the mid-1700s, with commercial versions developing by 1779. The essay discusses the numerous current kinds of sweet corn, which range in sweetness, color, and genetic alterations for increased resistance to pests and herbicides. The production technique for sweet corn needs careful selection of land, especially in peri-urban locations with well-drained soils, followed by comprehensive site preparation. Sweet corn is planted with precise planting procedures, seed treatment, and spacing requirements to promote maximum development and output. The introduction also discusses the employment of innovative agricultural equipment for land preparation, planting, fertilising, weeding,

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and plant protection, underlining the necessity for accurate and efficient farming procedures to achieve high-quality sweet corn output.
The essay also elaborates on the need of good field leveling, utilising instruments like the laser land leveler, and contemporary planting methods, such as zero-till planting and the use of pneumatic planters, to boost crop establishment and yield. Additionally, it includes numerous instruments for weeding and plant protection, including cultivators, sprayers, and acoustic devices for bird control, stressing the significance of technology in contemporary sweet corn cultivation.

Keywords: Sweet corn; variety; yield; land preparation; farming.

1. INTRODUCTION

Sweet corn (*Zea mays* var. saccharata) is a variant of field corn (*Zea mays*) characterized by a genetic mutation that enhances sugar content in its kernels. Originally discovered and cultivated in Pennsylvania around the mid-1700s, sweet corn differs from typical field corn due to its sweeter taste profile. The first commercial cultivar of sweet corn was developed in 1779.

Today, sweet corn comes in various hybrids and varieties, offering different levels of sweetness, colors (such as white, yellow, or bicolor), and genetic modifications for traits like herbicide resistance and insect control. Genetic advancements have improved both fresh and processed food quality, with ultra-sweet cultivars extending shelf life and enhancing market availability year-round.

Sweet corn is harvested before full maturity to capture its peak sweetness when sugar concentration is highest. It can be consumed fresh, canned, or frozen, catering to both fresh markets and processed food industries. While most sweet corn is harvested fully grown, there is also a niche market for baby corn, which is harvested immature and entirely edible.

2. PRODUCTION TECHNOLOGY

2.1 Land Selection

Since sweet corn needs to be used shortly after harvest, it is well-suited for peri-urban agriculture. Therefore, it can be grown economically in areas around major cities and towns that remain frost-free throughout the cultivation season [1]. Sweet corn thrives in well-drained soils with a pH range of 5.5 to 7.0, though it can be grown in a variety of soil types and is relatively salt-tolerant.

For successful cultivation, locations must have the capacity for 5 to 6 irrigation cycles, as moisture stress, especially during anthesis, can adversely affect both yield and quality. Since all genes controlling sweetness in corn are recessive, it is crucial to maintain a field isolation of 250 meters from other corn varieties or ensure a tasseling interval of at least 14 days to preserve genetic purity.

2.2 Land Preparation

The cultivation of sweet corn requires thorough initial soil preparation, including vigorous disc ploughing followed by leveling. Subsequently, ridges and furrows should be established with an inter-row spacing of 75 cm. It is recommended to incorporate farmyard manure (FYM) at a rate of 5–6 tonnes per hectare during the final ploughing stage.

Proper seedbed preparation and seed management are critical for all sweet corn varieties, particularly for super-sweet types. Ensuring good soil-to-seed contact, maintaining soil structure to avoid crusting, and managing appropriate soil moisture are essential for successful seedling emergence. Careful handling of seeds is especially important since damage to the seed coat can result in solute leakage, which can attract harmful fungi. Additionally, rapid and uniform seed emergence is vital for achieving consistent maturity across the crop [2].

2.3 Time of Sowing

In the kharif (rainy) season, planting takes place from June to July, whereas in the rabi (winter) season, it takes place from September to October.

2.4 Varieties

Both white and yellow grain varieties of sweet corn are cultivated. In India, some of the recommended sweet corn varieties approved for cultivation include Madhuri, Priya, and Almora sweet corn [3].

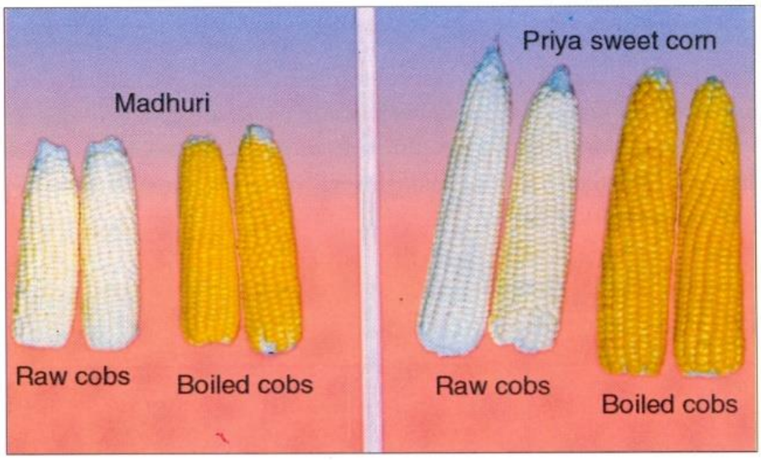

Fig. 1. Popular sweet corn varieties

2.5 Seed Rate

It is recommended to use fresh seeds each year, as seed quality and vigor tend to decline significantly within a year, especially for very sweet varieties. The optimal planting density for maximum yield is 45,000 to 60,000 plants per hectare, with a row spacing of 75–100 cm and a plant spacing of 15–30 cm within rows. To achieve this density, 10–11 kilograms of sweet corn seed per hectare are typically required.

Super sweet corn seeds have a high sugar content, resulting in smaller, crinkled seeds. These varieties generally have a higher seed count of around 500 seeds per kilogram compared to other sweet corn types, which have about 325 seeds per kilogram. Consequently, super sweet corn varieties require less seed, typically around 5–6 kilograms per hectare [4].

2.6 Seed Treatment

Applying Imidacloprid 70WS at a rate of 5 grams per kilogram of seed provides effective protection against insect pests for up to 30 days post-sowing. This treatment ensures early-stage defense, reducing the risk of pest-related damage during the crucial germination and seedling phases. In addition to insect control, it is advisable to treat seeds with an appropriate fungicide to safeguard against damping-off, a disease caused by soil-borne fungal pathogens that can lead to significant seedling loss. The combined approach of insecticide and fungicide treatments enhances seedling vigor and promotes healthy crop establishment, ensuring better overall yield potential.

2.7 Sowing Technique

Sweet corn is typically sown by placing two seeds per hill, either manually or mechanically, about one-third down from the peak on the side of the ridge slope. Sowing on ridges serves dual purposes: it conserves water and offers protection against waterlogging, a condition to which sweet corn is particularly vulnerable during its early growth stages. The recommended planting depth varies by cultivar. For most varieties, excluding super sweet types, the ideal depth is 3 to 4 cm. However, for super sweet cultivars, a shallower depth of 2.5 cm is optimal due to their unique seed characteristics.

Approximately 10 to 12 days after emergence, plants are thinned to a single plant per hill to promote healthy growth. When planting normal (su) and sugary enhanced (se) sweet corn varieties, it is advisable to sow no earlier than 7 to 10 days before the expected last severe frost. This timing minimizes the risk of frost damage and ensures better crop establishment. For effective pollination, it is recommended to plant at least three rows of each type during each sowing to enhance cross-pollination, which is crucial for kernel development.

Super sweet (sh2) corn varieties present additional challenges during planting. Their seeds are less vigorous compared to other sweet corn types, often resulting in uneven and lower crop stands. Research suggests that this reduced vigor is linked to several factors: lower starch reserves for germination, more fragile seed coats prone to fracturing, and higher carbohydrate content, which makes the seeds more susceptible to diseases. These characteristics necessitate careful handling and optimal planting conditions for successful crop establishment [5].

3. SOME SPECIAL FEATURES OF SWEET CORN

In conventional sweet corn cultivars, peak sugar content is maintained in the field for only about two days at 27°C or five days at 16°C before sugars begin converting into starch. Even when ears are harvested at peak sweetness, their quality quickly deteriorates as sugar content drops. Within 24 hours after harvest, sugar levels can decline by 8% at 0°C and up to 52% at 30°C. This rapid decline in sweetness makes it challenging to harvest sweet corn before starch accumulation begins and to deliver it to consumers while sugar levels remain high.

For these reasons, supersweet cultivars have become the preferred choice for commercial sweet corn production. Supersweet varieties, which convert sugar to starch more slowly both on the plant and after harvest, retain their sweetness longer. Although many sweet corn varieties with higher sugar content are often called "supersweets," only those containing the sh2 gene should be technically labeled as such. The name "shrunken 2" comes from the fact that these kernels have such low starch content that they appear shriveled, especially compared to conventional sweet corn with the su1 gene. Peak sugar levels in sh2 hybrids range from 22% to 40%, compared to just 5% to 11% in traditional sweet corn varieties. While sh2 hybrids are expected to dominate future commercial sweet corn production, some consumers find them overly sweet and lacking the traditional flavor and soft texture of conventional varieties. However, newer supersweet cultivars have softer kernels that more closely resemble those of standard sweet corn.

Despite these advancements, sh2 hybrids still pose challenges for growers due to the need for strict isolation from other corn varieties. Additionally, the first supersweet varieties were more difficult to cultivate, and even the latest sh2 hybrids require careful management.

For roadside markets or growers who plan to sell or consume the corn within 1-2 days of harvest, sweet corn varieties with the se gene offer an alternative. These sugar-enhanced types start with higher sugar levels than conventional corn but convert sugar to starch at a similarly fast rate after harvest. Homozygous se cultivars have peak sugar levels of 12% to 20%, while heterozygous se varieties have sugar levels of 7% to 15%. The key advantages of these cultivars are their tender kernels and creamy texture, often described as having a "genuine corn flavor," similar to conventional sweet corn. Additionally, se cultivars have better seedling emergence traits and less stringent isolation requirements compared to sh2 hybrids. If planted near standard sweet corn, individual kernels may resemble those of conventional corn, which is less problematic than the starchy, hard kernels that can result when standard sweet corn pollinates sh2 varieties [6].

4. LAND PREPARATION

4.1 Mould Board (MB) Plough

This equipment is primarily used for tillage operations, where it turns the soil, cuts crop residues, and buries them within the soil. It is also utilized for incorporating and mixing green manure crops, compost, farmyard manure, lime, and other soil amendments into the soil.

List 1. Specifications of MB plough

Dimension (m)	1.77´0.88´1.09
Weight (kg)	253
Power requirement	45 hp tractor
Approx cost (INR)	30,000

Fig. 2. MB plough

4.2 Disc Plough

The disc plough is a primary tillage implement specifically designed for working in challenging conditions such as stony, hard, dry, and trashy soils. It is also effective in soils where scouring is a significant issue, making it well-suited for breaking up tough ground and handling residues efficiently.

4.3 Tyne Type Cultivator

The cultivator is a secondary tillage implement used primarily for seedbed preparation. It is also employed for intercultural operations and weeding in wider row crops such as maize, particularly after adjusting the spacing of its tines to accommodate the row width (List 3, Fig. 4).

4.4 Rotavator

The rotavator is a versatile secondary tillage implement that performs multiple tasks in a single operation, including harrowing, leveling, weed control, and incorporation of manures, fertilizers, and leftover crop stubble. It effectively breaks down larger clods and pulverizes the soil, preparing a seedbed in one pass. This efficiency results in reduced draft power requirements, time, labor, and costs compared to traditional tillage methods.

In intensively farmed areas where time for seedbed preparation is limited, the rotavator can be particularly valuable. However, continuous use may lead to subsurface compaction just below the operating depth, which can cause water accumulation during heavy rainfall. Despite this potential issue, the rotavator decreases land preparation costs by ₹1000-1500 per hectare compared to traditional methods [7] (List 4, Fig. 5).

List 2. Specifications of Disc plough

Disc size (mm)	600-800
Width of cut per disc (mm)	200-300
Weight (kg)	236-376
Adjustable working width (mm)	600-1200
Working depth (mm)	Up to 300
Disc angle (°)	40-45
Tilt angle (°)	15-25
Power requirement	35-50 hp tractor
Approx cost (INR)	30,000

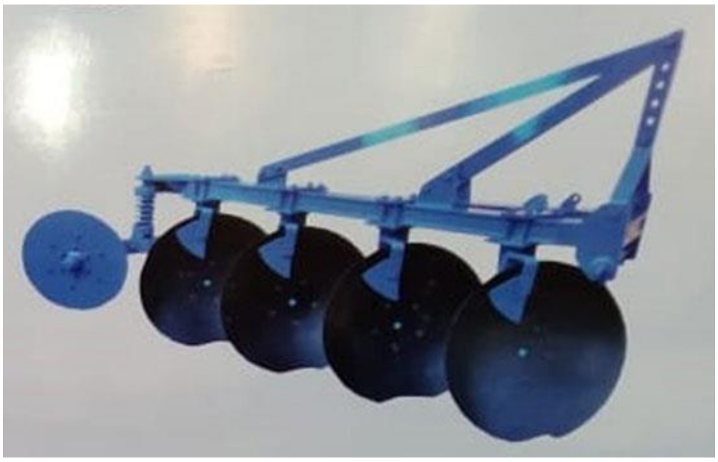

Fig. 3. Disc plough

List 3. Specifications of cultivator

Dimension (m)	1.96-3., 0.97-1.56, 1.07-1.35
No of tynes	9-13
Diameter of spring wire (mm)	9.5
Power requirement	35 hp tractor
Approx cost (INR)	25,000-30,000

Fig. 4. Tyne type cultivator

List 4. Specifications of Rotavator

Working width of rotavator (m)	1-2
Shape of blade	L shape
Orientation of blade (°)	45-47
Total no of flanges	6-8
No of blades per flange	6
Weight (kg)	280-415
Revolution of rotor shaft (rpm)	210-237
Power requirement	35-50 hp tractor
Field capacity (ha/h)	0.25
Approx cost (INR)	65,000 to 80,000

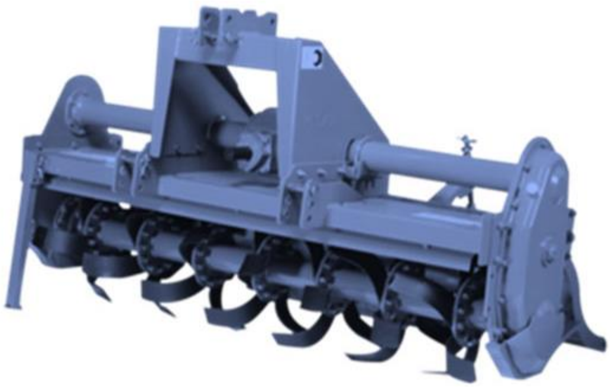

Fig. 5. Rotavator

4.5 Laser Land Leveler

Fields with undulating terrain often experience uneven crop stands due to variations in seed planting depth and rainfall distribution. This irregularity can result in runoff, erosion, and non-uniform crop maturity, leading to increased energy and costs for field preparation. Additionally, excess soil moisture in lower areas can cause waterlogging and leaching, while moisture shortage on higher elevations can hinder water and nutrient uptake.

Land leveling is crucial for improving resource use efficiency and addressing these issues. The laser land leveler offers precise ground leveling, which creates a more uniform moisture environment and consistent crop stand. This technology not only helps in saving on expensive agricultural inputs such as seed, fertilizer, and irrigation but also reduces runoff and the impact of agro-chemicals on the environment, addressing various environmental challenges [8].

List 5. Specifications of laser land leveller

Laser Source	< 5 mw 635 nm
Operating diameter(m)	Above 800
Grade range (%)	–10 to +15 Dual Axes
Grade accuracy (%)	0.015, 3 mm@30 m
Remote control type	Full 2-way communication
Power requirement (hp/KW)	60/45
Approx cost (INR)	3,50,000

Fig. 6. Laser land leveler

5. SOWING

Maize and multi-crop planters are designed to discharge a consistent number of seeds and fertilizer across the field. Unlike seed drills, which may not ensure uniform spacing, these planters maintain the required plant-to-plant distance. This precision results in increased crop yields and helps preserve the use of costly seeds by optimizing their distribution.

List 6. Specifications of Multi crop planter

No of rows	3-6
Row to row spacing	24 inch standard and adjustable
Fertilizer metering	Agitator and sliding orifice type
Seed dropping	Rotating disc with cells on its periphery
Approx cost (INR)	40,000-50,000

Fig. 7. Multi-crop planter

5.1 Ridge Planter

Maize is particularly vulnerable to both waterlogging and drought, which can lead to significant yield losses. Bed planting is an effective method for managing these challenges by adapting to varying rainfall conditions. In times of excess rainfall, the furrows created by bed planting function as drainage routes, preventing waterlogging. Conversely, during periods of low rainfall, the furrows help to accumulate and retain rainwater, benefiting the crop.

Ridge planters are commercially available tools that can create planting beds and sow seeds on the bed tops in a single operation. This method offers several advantages, including enhanced root growth, reduced waterlogging, and more efficient irrigation water use. Ridge planting also significantly reduces operational costs and time—by 24% and 90%, respectively—compared to traditional methods [9] (List 7, Fig. 8).

5.2 Zero till Planter

In traditional agriculture, seedbed preparation typically involves one ploughing followed by 2-3 harrowings and planking. This process, which uses 4-5 tractor passes and associated heavy equipment, can crush soil particles and affect soil structure, leading to compaction issues that inhibit seedling emergence, root penetration, soil aeration, and water flow. Additionally, traditional tillage requires significant fuel, extended turnaround times, and increased manpower, raising agricultural costs.

An alternative to traditional tillage is no-till planting, where seeds are planted directly into the stubble of the previous crop without any soil disturbance or additional tillage activities. This technique reduces capital expenditure on land preparation and intercultural operations, offering a feasible substitute to conventional tillage-intensive methods. No-till planting is widely adopted in countries such as the USA, Canada, Argentina, and Australia.

In India, zero-till maize planting has been introduced in coastal Andhra Pradesh within the rice-maize system. This approach conserves fuel, reduces tractor working time, and minimizes manpower, allowing for timely crop seeding. When paired with residue mulching, zero-till planting improves hydro-thermal conditions and provides better protection for crops under adverse circumstances [10] (List 8, Fig. 9).

List 7. Specifications of Ridge planter

No of rows	2-5
Row to row spacing	24 inch standard and adjustable
Fertilizer metering	Agitator and sliding orifice type
Seed dropping	Rotating disc with cells on its periphery
Field capacity (ha/day)	3.5

Fig. 8. Ridge planter

List 8. Specifications for Zero till maize planter

Seed dropping	Rotating disc with cells on its periphery
Fertilizer metering	Agitator and sliding orifice type
No. Of rows	Available in 3-6 rows
Row to row spacing	24 inch standard (maximum) and adjustable
Furrow openers	Inverted 'T' type
Approx cost (INR)	45,000

Fig. 9. Zero till planter

5.3 Pneumatic Planter

Uniform planting depth and precise spacing between seeds are crucial for ensuring consistent germination and conserving expensive hybrid maize seeds. Pneumatic planters are effective tools for achieving these requirements in maize cultivation. They provide consistent crop establishment and improve crop stand quality, which can boost maize yields by 10-20%.

These planters can be made available at custom hiring centers, allowing farmers to access them without the need for individual ownership, thereby facilitating more efficient and cost-effective maize planting.

List 9. Specifications of Pneumatic planter

No. of rows	2,4, 6
Row to row spacing	12 inch minimum and adjustable
Fertilizer metering	Fluted roller
Seed metering	Vertical rotating disc pneumatic seed picking
Sowing depth	Adjustable
Furrow opener	Shovels for sowing in tilled/prepared field
Approx cost (INR)	4-6 lakhs

Fig. 10. Pneumatic planter

5.4 Happy Seeder

The Happy Seeder is an advanced agricultural implement designed for efficient residue management and planting. It features a straw management rotor equipped with flail-type straight blades that cut and shear standing stubble and loose straw in front of the sowing tines. Each tine is cleaned twice per rotation of the rotor, ensuring effective residue management and preventing clogging (List 10, Fig. 11).

The flail blades push the remaining crop residues across the surface between planted rows, facilitating even distribution and better soil preparation. This integrated approach allows for zero-till planting while managing previous crop residues, enhancing overall efficiency and soil health.

5.5 Wide Bed Planter

This planter is designed for simultaneous broad bed making and maize planting in a single operation. It can prepare two raised beds per pass, with two rows of maize sown on the tip of each bed. This dual-function capability streamlines the planting process, reducing the number of operations needed and improving overall efficiency in bed preparation and seed placement (List 11, Fig. 12).

List 10. Specifications for Happy seeder

Seeding metering	Fluted rollers type
Power source	45-50 hp tractor
Field capacity (ha/hr)	0.3-0.4
Cost (INR)	Approximate 1.3 lakh

Fig. 11. Happy seeder

Fig. 12. Wide bed planter

List 11. Specifications for Wide bed planter

Seed metering	Fluted Roller / Rotating Disc with cells on its perifery
Fertilizer metering	Agitator and sliding orifice type
Power source	45 hp tractor
Cost (INR)	Approximate 1.3 lakh

6. FERTILIZER APPLICATION

6.1 Tractor Mounted Fertilizer Broadcaster

This equipment is used for the uniform broadcasting of granular fertilizer. It primarily consists of a hopper and a spinning disc. Fertilizer is dispensed from the hopper onto the rapidly rotating disc, which distributes the fertilizer evenly across the field. This design ensures consistent application and efficient coverage of the granular fertilizer.

The tractor-driven three-row fertilizer band placement cum earthing-up machine performs three essential tasks in a single operation:

Fertilizer Placement: It applies fertilizer at a rate of 60 to 250 kg per hectare along the row, positioned 50 to 100 mm away from the plants.

Earthing Up: It covers up to 10 cm of the stem height, aiding in plant stability and soil protection.

Weed Cutting: It effectively cuts weeds, helping to manage weed growth and reduce competition for resources.

This machine offers significant benefits over traditional methods, including substantial savings in fertilizer, time, and labor. The field capacity of the machine is 0.56 hectares per hour, and its estimated cost is ₹50,000.

List 12. Specifications for Fertilizer broadcaster

Type	Tractor mounted
Hopper capacity	500 liter fertilizer
Fertilizer spreading mechanism	High speed rotating disc
Hitching	3 point linkage
Fertilizer spreading width	20-30 feet
Field capacity (ha/h)	2.5

Fig. 13. Fertilizer broadcaster

7. WEEDING

7.1 Cultivator

Cultivators are commonly used for intercultural operations and weeding, with adjustments made to the tyne spacing to suit different crops. Mechanical weed management with tractor-mounted cultivators is typically limited to early crop stages due to the restricted ground clearance, which can damage the crop canopy during later growth stages. To prevent injury to plant roots, the working depth of the cultivator should be kept moderate.

The self-propelled power weeder is a diesel engine-driven machine with a 50 cm operating width. It can cover an area of 1 to 1.2 hectares per day and is suitable for inter-culture operations and inter-row weeding in crops such as tapioca, cotton, sugarcane, maize, tomatoes, and pulses, provided the row spacing is greater than 45 cm. The weeder's tines can be adjusted or replaced to match the row spacing and required operating depth of the crop. Additionally, attachments such as sweep blades, ridgers, and trailers can be mounted to enhance its functionality.

List 13. Specifications for Power weeder

Working width (mm)	350-500
Power source	3 hp engine
Field capacity (ha/h)	Weeding- 0.06 Earthing up-0.14
Approx cost (INR)	80,000

7.2 Tractor Mounted 3-row Rotary Weeder

The rotary type inter-row weeder is capable of cleaning three successive rows (1600 mm width) in a single pass. It effectively destroys weed roots and removes them from the soil, while also creating a dust mulch that conserves soil moisture and aids in soil aeration. This type of weeder is suitable for broad row crops, such as cotton and maize, with row spacings of 45-90 cm, allowing the tractor to operate between rows without disturbing the crop zone.

The width of the inter-row rotary weeder can be adjusted to match the row spacing of the crop. For optimal weeding efficiency with minimal crop damage, the crop height should be kept under 55 cm [11].

List 14. Specifications for Rotary weeder

Type	Rotary type
No. of rotary weeder units	3
No. of blades per flange	4
Row spacing (mm)	675-1165 (adjustable)
Field capacity (ha/h)	0.24
Operation efficiency (%)	83-87
Approx cost (INR)	60,000

Fig. 14. Rotary weeder

8. PLANT PROTECTION

8.1 Air Assisted Horizontal Sleeve Boom Sprayer

The boom sprayer is designed to cover large areas quickly and efficiently, making it ideal for wide-space row crops with ample row-to-row spacing to accommodate the tractor's movement. When using a boom sprayer, crop planting should be arranged in rows that align with the tractor's track width to ensure optimal operation.

However, the clearance provided by the boom sprayer's mounting frame is generally insufficient for crops taller than 45 cm. Therefore, these sprayers are most suitable for pre-emergence and early post-emergence applications of agro-chemicals. The boom sprayer can cover 1.12 to 1.25 hectares per hour, enhancing its efficiency for large-scale spraying tasks (List 15, Fig. 15).

8.2 Self-propelled High Clearance Sprayer

The self-propelled high clearance sprayer is particularly suited for application on tall crops such as cotton and maize. It features 18 nozzles spaced 67.5 cm apart, and the track width of 1.35 meters allows it to straddle two rows of 67.5 cm spacing, placing its wheels in the inter-row zone.

The sprayer's boom width is 10.80 meters, and the height can be adjusted between 31.5 cm and 168.5 cm to accommodate varying crop heights. To prevent mechanical damage, fenders are fitted in front of the drive wheels to deflect crop branches away from the wheels.

The sprayer has an average capacity of 1.8 hectares per hour, with a cost of approximately ₹485 per hour for operation (List 16, Fig. 16).

List 15. Specifications of Boom sprayer

Dimension (m)	6.34´1.29´1.57
Tank capacity (liters)	400
Weight (kg)	150
Adjusted range of boom height (m)	0.3-1.26
Spacing between two nozzles (mm)	460
Spray swath (m)	10.2
Power requirement	35 hp tractor
Field capacity (ha/day)	8 (with 14 nozzles)
Approx cost (INR)	50,000

Fig. 15. Boom sprayer

List 16. Specifications of Self-propelled high clearance sprayer

Ground clearance of machine (m)	1.2
No. of gears	4
Length of boom (m)	10.8
No. of nozzles	18
Nozzles spacing (cm)	67.5 (fixed)
Width of coverage (m)	10.8-13.5
Tank capacity (liters)	1000
Maximum field speed (km/h)	5
Power required	20 hp diesel engine
Approx cost (INR)	80,000

Fig. 16. Self-Propelled high clearance sprayer

8.3 Q-5AC Acoustic Device for Bird Management

Birds, particularly around 10 different species, are known to cause significant damage to maize crops, with yield losses ranging from 10% to 40%. To address this issue, the Autonomous Electrical Sound Generating Gadget, developed by the AINP on Agricultural Ornithology, has been introduced. This acoustic device deters pest birds by emitting recorded sounds of bird predators and warning cries.

The gadget is weather-resistant and must be installed on a pole, one foot above the crop canopy. It is designed to protect approximately 4 acres of crops from bird damage. The estimated cost of the device is ₹9,000, making it a practical solution for mitigating bird-related yield losses.

9. HARVESTING

The self-powered maize combine harvester is designed for the direct harvesting and threshing of maize crops. It features a specially designed cutting bar tailored for maize, along with a collection mechanism that directs stalks into the machine. The snapping rollers are used to efficiently remove the ears from the stalks.

List 17. Specifications of maize combine harvester

Cutter bar width (m)	3.65
Cutting height (mm)	100-1000
No. of straw walker	5/7
Area of straw walker (m^2)	0.89
Row spacing (mm)	460-685
Type of threshing bar	Rasp bar
Power requirement	75-110 hp
Working capacity (ha/h)	1
Approx Cost (INR)	12-14 lakh

Fig. 17. Combine harvester

In addition to maize, the harvester can be adapted for various cereal crops by changing the header. This versatile machine has the capacity to harvest one hectare per hour, making it an efficient choice for large-scale maize harvesting.

10. THRESHING

10.1 Maize Dehusker-sheller

List 18. Specification of Maize dehusker sheller

Type of threshing drum	Spike tooth
Type of blower	axial flow
Moisture content of cob (%)	12-18
Cylinder speed (rpm)	670-750
Threshing capacity (q/h)	15-20
Threshing efficiency (%)	98-99.5
Cleaning efficiency (%)	90-95
Power requirement	26.25 kw
Approx cost (INR)	60,000

Fig. 18. Maize dehusker and sheller

This dual-purpose machine is designed for both the removal of maize cobs' sheaths and the separation of kernels from the cobs in a single operation. It offers significant efficiency improvements over traditional methods, reducing shelling time by 95% and shelling costs by 60%. This makes it a cost-effective and time-saving solution for maize processing.

11. GRAIN DRYING

11.1 Mobile Batch Dryer

Fig. 19. Grain drying

The dryer is a PTO or electricity-driven, portable, and durable machine suitable for drying various types of grain without the need for pre-cleaning. It is designed to minimize risks of blockages and hot spots. The drying rate ranges from 2 to 10 tons per hour, depending on the crop type, grain moisture content, and other factors [12].

12. CONCLUSION

The study concluded that numerous instruments for weeding and plant protection, including cultivators, sprayers, and acoustic devices for bird control, stressing the significance of technology in contemporary sweet corn cultivation.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERANCES

1. Revilla P, Anibas MC, Tracy FW. Sweet Corn Research around the World 2015–2020, Multidisciplinary Digital Publishing Institute. 2021;11(3):534-534. Available:https://doi.org/10.3390/agronomy11030534
2. Edun TB, et al. Seed Health, Quality Test, and control of seed-borne fungi of some improved and Local Cultivars of Rice (*Oryza sativa* L.) in Kano, Northwestern Nigeria. 2019;6(03):145-152. Available:https://doi.org/10.29244/jtcs.6.03.145-152
3. Rana BJ, Singh J, Kumar S. Maize Production viability-a study of economics, constants and policy implications for Eastern Uttar Pradesh, India, Excellent Publishers. 2018;7(06):2776-2783.

Available:https://doi.org/10.20546/ijcmas.2018.706.326

4. Burgmans LJ, Lill ER. Sweet corn: Observations on supersweet cultivars for processing and fresh-market use in New Zealand; 2023. Available:https://www.tandfonline.com/doi/abs/10.1080/03015521.1987.10425559
5. Uğur A, Maden AH. Sowing and planting period on yield and ear quality of sweet corn (*Zea mays* L. var. saccharata), Federal University of Lavras. 2015;39 (1):48-57. Available:https://doi.org/10.1590/s1413-70542015000100006
6. Troyer F. Background of U.S. hybrid corn II: Breeding, climate, and food; 2023. Available:https://acsess.onlinelibrary.wiley.com/doi/10.2135/cropsci2004.3700
7. Adamu H, et al. Production processes, techno-economic and policy challenges of bioenergy production from fruit and vegetable wastes, Elsevier BV. 2023;186:113686-113686. Available:https://doi.org/10.1016/j.rser.2023.113686
8. Zhao T, Li W. Design Configuration and Technical Application of Rotary-Wing Unmanned Aerial Vehicles. 2022;1(1). Available:https://doi.org/10.56578/mits010108
9. Rajaiah P, et al. Development and evaluation of mini tractor operated ridge plastering machine, AkiNik Publications. 2020;8(5):45-48. Available:https://doi.org/10.22271/chemi.2020.v8.i5a.10369
10. Nguyen P, et al. Development of criteria for high-technology rice and corn suitability assessment – a case study in the an Giang province, Viet Nam, Polish Society of Ecological Engineering. 2023;24(1):239-247. Available:https://doi.org/10.12911/22998993/156095
11. Saleh A, Suleiman LM. Design, construct and evaluation of a single row Hand-Pushed Mechanical Weed Control Machine. 2021;25(3):401-406. Available:https://doi.org/10.4314/jasem.v25i3.14
12. Gbabo A, Efomah NA, Mohammed IG. Design, fabrication and testing of a platform with Steam Heat Exchangers for Drying of Parboiled Paddy Rice and Other Agricultural Products. 2017;1(2). Available:https://doi.org/10.22606/afse.2017.12003

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