Design of Combine Groundnut Harvester

MSME name - Bharat engineering works
City - Jasdan
State - Gujarat
Zone - West

Designer/Firm - SKM designs private limited
City - Faridabad

Approved cost : Rs. 2000000
Start Date : 08-01-2013
Completion date : 27-04-2014
Groundnut Harvester Design

Participants:
Bharat Engineering Works
Mahesh Mechanical Works
Bhagwati Mechanical Works
Solanki Industries

Groundnut Harvester machine not manufactured in India. This for the first time the cluster is getting it developed under the MSME-NID Design Clinic Scheme

Sample machine from abroad
PHASE 1 – RESEARCH
Design Phase 1
Specification List for Groundnut Combine Harvester Design

**Function:** To pickup dried groundnut from field, take into the machine, do threshing, cleaning, grading, separation of pod and dried leaves, collection system

Main components:

**Collection system**
Drum & round flat pulley type system with bar for lifting plant

**Conveying system**
Chain with sprocket and cross bar like digger inverter

**Threshing Drum**
3-4 round ring with flat cutter with peg on upper head

**Cleaning System: use of blower**
The grader with 3 cleaning and grading sieves with the short size than the existing grader

**Grading System**
As above

**Collection System**
One blower for the collection of groundnut at the outlet for lifting the groundnut pod and to pass on to the collection center
**Prime Mover:** 35 HP Tractor for driving the harvester in field and harvesting operation. The harvester will be connected with tractor with PTO Shaft and eye bolt.

**Specifications of Combine Harvester**
- Width of collection: 4 feet - 8 feet
- Primary and Secondary Cutters
- Threshing Drum: 8 feet wide
- Speed: 10 KM/Hr
- Capacity: 5 Acre/Day
- Operated by 35 HP Tractor, tractor attached to PTO shaft
- Mobile Device: 2 wheels
- Size: Width equal to tractor trolley, 4 feet width, 8-10 feet length, 8 ft height
- Suitable for 2 rows
- Cost: 10-12 Lakhs
- Weight: within 2.5 Ton
- Size: 10’ x 10’ x 8’

**Manufacturing Process:** Should be possible available process in Jasdan, shearing machine, hydraulic press, angle and channel cutting, automatic gas cutting, CNC Punch machine, Welding system, CNC Bending,
General

Digging: Without digger it cost very high per acre: Rs. 1000.00
Some of the pods left in field by manual method.
Less time by harvester
Less Labour
Wastage and theft, manipulation, wastage birds and other animals
Fodder is safe and quality is good without dust, high value Rs. 3-4 per Kg.
Use in bio-coal, biomass for thermal application.
Rain problem and crop sensitivity and spoilage.

Material: MS and Galvanised sheets, Shafts, bearing, mechanical power systems

Construction:
It should be longer than the existing thresher and the height is to be lowered down with total covering like Tamilnadu version.

Blower:
One piece having more capacity of air flow. Rear installed and linked with the main shaft. Other fan assembly completely avoided.
Collection of Fodder:
Collection of the fodder can be done with the help of extra trolley attached at the rear side and it must be folding type and hydraulically lifted. The front portion may be divided for the collection of varieties.

Collection of Pod:
The collection of pod should be done

Wet Type:
Digger Assembly: At the front of the harvester the digging is to be done by the differ with side arm
Cutting assembly: It will be like wet crop thresher
Existing Groundnut Harvester from Internet

Note:
Groundnut Harvester machine not manufactured in India. This for the first time the cluster is getting it developed under the MSME-NID Design Clinic Scheme
Crop Biology

- Height: 18-22 inch
- Depth: 6 inch approx
- Crop grows in cluster
- Required grain in soil
Detailed Product Description
Model: 4HB-2A
Self-propelled:
Matched Power: 22.1KW
Lose ratio: ≤2%
Working Efficiency: 0.13-0.30 ha/h
Broken ratio: ≤1%
Weight: 1700kg
Cleanness: ≥95%
Overall dimension: (LxWxH)
3970x1800x2070mm
Working width; ridge spacing
750mm-850mm
line spacing 180mm-250mm
Detailed Product Description

Technical parameters:
Self-propelled:
Matched Power: 30hp
Lose ratio: ≤1%
Working Efficiency: 0.13-0.30 ha/h
Broken ratio: ≤1%
Weight: 1750kg
Cleanness: ≥95%
Overall dimension: (LxWxH)
3970x1800x2070mm
Working width: ridge spacing 750mm-850mm
line spacing 180mm-250mm

Feature:
Peanut excavation, fruit picking, cleaning, storing, bagging process, transportation once complete.
Using wheeled self-propelled, semi-fed-type pick, combine to enhance new technologies such as cleaning machine's performance so much better for most of the country cried cropping patterns and soil conditions.
Peanut combined harvester
Currently, the most popular and traditional mechanized methods of harvesting peanut can be divided into two stages. The first stage is to dig out fruited peanut plant by trailed harvesters powered by tractors, shake off the soil on those peanuts, and pile them up in the sunshine for airing. The second stage is to pick off the fruits by special equipment. Obviously, the efficiency is quite low. Our peanut combined harvester is innovative with special patents. This harvesting machine has multiple functions, including digging out fruits, pulling up seedlings, clamping convey, shaking off soil, picking up fruits, vibration sieving, separating by roller and chain, cleaning by fan and collecting fruits. It features high efficiency, compact structure, flexible transfer, and can be easily adapted to soils with different moisture conditions. Since the labor cost keeps increasing, it should be your first choice.
<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product model</td>
<td>4HB-2A</td>
</tr>
<tr>
<td>Power</td>
<td>22KW/30HP</td>
</tr>
<tr>
<td>Digging depth</td>
<td>100-200mm</td>
</tr>
<tr>
<td>Harvest width</td>
<td>600mm</td>
</tr>
<tr>
<td>Productivity</td>
<td>0.1-0.15 ra /h.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>43000×1800×2250 (mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>1800kg</td>
</tr>
<tr>
<td>Loss rate</td>
<td>≤3%</td>
</tr>
<tr>
<td>Dirt percentage</td>
<td>≤5%</td>
</tr>
<tr>
<td>Breakage rate</td>
<td>≤1%</td>
</tr>
<tr>
<td>Integrity rate of straws</td>
<td>≥98%</td>
</tr>
<tr>
<td>Max. speed on flat road</td>
<td>20Km/h</td>
</tr>
<tr>
<td>No. of gears</td>
<td>7 (1 in reverse and 6 forward)</td>
</tr>
</tbody>
</table>

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Models available:

- Model 3374 - 4 Row
- Model 3376 - 6 Row

Small diameter, spring tooth header reel makes for gentle vine pickup that reduces losses at the header.

Adjustable strippers provide efficient threshing with low LSK rates in a wide range of vine conditions.

Separation screen in combination with adjustable air flow provides for efficient separation and reduces losses in various harvesting conditions.

Double swivel gear box allows sharp turns which improves harvesting efficiency, and also eliminates troublesome CV drive lines.

Large single wheels provide good flotation in soft/boggy field conditions.
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# Peanut Combine Dimensions

<table>
<thead>
<tr>
<th>Header Size</th>
<th>Inside Pickup Width</th>
<th>Outside Header Width</th>
<th>Outside Tire Width</th>
<th>Tire Center Line Width</th>
<th>Tongue Offset from Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 36 Std</td>
<td>132 in / 335.3 cm</td>
<td>142 in / 360.7 cm</td>
<td>151 in / 383.5 cm</td>
<td>132 in / 335.3 cm</td>
<td>36 in / 91.4 cm</td>
</tr>
<tr>
<td>4 x 40 Aus</td>
<td>148 in / 375.9 cm</td>
<td>158 in / 401.3 cm</td>
<td>151 in / 383.5 cm</td>
<td>132 in / 335.3 cm</td>
<td>36 in / 91.4 cm</td>
</tr>
<tr>
<td>4 x 42 Aus</td>
<td>156 in / 396.2 cm</td>
<td>166 in / 421.6 cm</td>
<td>151 in / 383.5 cm</td>
<td>132 in / 335.3 cm</td>
<td>36 in / 91.4 cm</td>
</tr>
<tr>
<td>6 x 30 w/4R Axle</td>
<td>172 in / 436.9 cm</td>
<td>182 in / 462.3 cm</td>
<td>151 in / 383.5 cm</td>
<td>132 in / 335.3 cm</td>
<td>0 in</td>
</tr>
<tr>
<td>6 x 30 w/6R Axle</td>
<td>172 in / 436.9 cm</td>
<td>182 in / 462.3 cm</td>
<td>168.5 in / 428 cm</td>
<td>149.7 in / 380.2 cm</td>
<td>0 in</td>
</tr>
<tr>
<td>6 x 36 Std</td>
<td>212 in / 538.5 cm</td>
<td>222 in / 563.9 cm</td>
<td>190 in / 482.6 cm</td>
<td>161.2 in / 409.4 cm</td>
<td>0 in</td>
</tr>
<tr>
<td>6 x 40 / 8 x 30 Std</td>
<td>228 in / 579.1 cm</td>
<td>238 in / 604.5 cm</td>
<td>190 in / 482.6 cm</td>
<td>161.2 in / 409.4 cm</td>
<td>0 in or 30 in / 0 cm or 76.2 cm</td>
</tr>
</tbody>
</table>
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Process

1. Collection of the crop
2. Cut the groundnut and plant
3. Separate the groundnut from plant
4. Pull out the waste and proper treatment of groundnut
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Cutting Technology

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• Ball mill cutter or fly cutter
• Fly cutter have greater tendency of cutting because it have good cutting force
• Assumption:
  • Dia = 10cms
  • We use 8 teeth
  • One piece size is around 7.8cms
Materials

Material that has been used in groundnut harvesters are:
1. Mild steel sheets
2. MS Angles, channels, bars, flats, rounds,
3. Wood
4. Plastics
5. Rubber
Bucket Conveyor
Field Visits to see Chinese Harvester
Field Visits
Field Visits
Field Visits
Field Visits
Field Visits
Field Visits
Field Visits
Design Project PDP-12 163

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Peanut Cleaning Machine
User’s Survey & Analysis

User’s Survey not become possible for two reasons: harvesting season and availability of machine to see its working. One China Groundnut Harvester was seen at Himatnagar near Ahmedabad. We could start the machine and video shoot to see the mechanism. This harvester is designed for wet crop would not be suitable for dry crop.

There is need of Groundnut Harvester because of acute labour problem and laborious job. Groundnut fields are very big usually and only thresher is the available machine that help in threshing. User need to collect and bring the crop from far off and put in the thresher to get the pods.

The mobile harvester will solve all the current problems. The proposed groundnut harvester machine will get attached to existing tractor, one man driven, goes to field, collect the crop convey to thresher for pod separation and clean all leaves, stem, mud and stone.
Study of Manufacturing Process & Analysis

The manufacturing process was studied in detail and captured in Design Clinic Need Assessment Study Report submitted to MSME-NID.

The process is all manual and labour oriented. This need to be upgraded to modern machines for metal cutting and joining. Cluster is trying to avail CFC scheme and all prepared to apply for the facility.

As of now Rajkot which is 45 KMs from Jasdan can help in the gap.
Harvester Schematic Drawings and IS Standards

Design team have put in all efforts to understand the actual need and tried to develop a right mechanism that can constitute a Groundnut Harvester. Inspirations has been taken from wheat and other harvesters. The new schematics will be different from others and suitable for Indian fields.
PHASE 4 – PROTOTOTYPE
Analysis & Design Specifications

**Function:** Design and Groundnut Harvester that can be attached to tractor can be taken to field. This is designed to pickup dried groundnut from field, take into the machine, do threshing, cleaning, grading, separation of pod and dried leaves, collection system

Main components:
- **Collection system**
  Drum & round flat pulley type system with bar for lifting dry crop
- **Conveying system**
  Chain with sprocket and cross bar like digger inverter
- **Threshing Drum**
  3-4 round ring with flat cutter with peg on upper head
- **Cleaning System: use of blower**
  The grader with 3 cleaning and grading sieves with the short size than the existing grader
- **Grading System**
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  One blower for the collection of groundnut at the outlet for lifting the groundnut pod and to pass on to the collection centre
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Collection of the fodder can be done with the help of extra trolley attached at the rear side and it must be folding type and hydraulically lifted. The front portion may be divided for the collection of varieties.

Collection of Pod:
The collection of pod should be done within the machine and to be emptied using power screws or gravity discharge.

Wet Type:
Digger Assembly: At the front of the harvester the digging is to be done by the differ with side arm
Cutting assembly: It will be like wet crop thresher
FINAL PRODUCT
End of the Report