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Mechanization of groundnut crop in Anantapur district of Andhra Pradesh

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Abstract
Groundnut is an important oil seed crop in India and is the predominant dryland crop grown in an area of 5.8 million ha with a production of 5.5 million tons annually. As the soil moisture availability is limited to a very short period in dry land agriculture, timely sowing is crucial for groundnut crop establishment. Also other operations like intercultivation, harvesting and threshing should be done at correct time to get better productivity and good market price for product. Traditional methods of field operations require huge number of labour and more time ultimately lead to increase in cost of cultivation. Acute shortage of labour is experience now a days during field operations due to increased industrialization and other opportunities for labour. To overcome the shortage of labour and to perform the field operations at right time and to take the advantage of favorable situation in dry-land conditions, the farmers can go for farm mechanization by the use of efficient and improved tools, equipment and machines suitable to the Indian dryland soil conditions for groundnut crop cultivation.

Keywords: Groundnut crop, predominant dryland crop, mechanization

Introduction
Groundnut is the 13th most important food crop and 4th most important source of edible oil of world. It is grown in nearly 100 countries in an area of 28 million ha with a total production of 37 million tons with an average productivity of 1.4 tons/ha (FAO, 2010) [2]. Major groundnut producers in the world are China, India, USA, Nigeria, Indonesia and Sudan. Groundnut is the largest oil seed crop grown in India in an area of 6.7 million ha with a production of 7.0 million tons annually. Out of total cultivated area for groundnut, 5.8 million ha (85% of total area) is under dry land agriculture or rain fed conditions with an average productivity of 0.8 tons/ha.

In Andhra Pradesh, groundnut is grown on 1.05 million ha during the *Kharif* season with a production of 1.6 million tons under rain fed conditions and during the *Rabi* season, it is grown under irrigated conditions in 0.2 million ha with a production of 0.4 million tons. Anantapur district in the state of Andhra Pradesh is the largest producer of groundnut as a dryland crop with 0.8 million ha of area under cultivation in rainfed conditions. The average rainfall of Anantapur district is about 550 mm only and soils in the district are mostly light soils (Alfisols) with less water holding capacity and sloppy in nature. In order to get the benefit of moisture in the soil, the farmer has to do the important field operations like sowing within the short time before the moisture gets evaporated from the soil. Inter-cultivation operations should be done at correct time in order to get better yield and also crop should be harvested and threshed within short periods because sometimes untimely heavy rains spoils the produce. Traditional methods of field operations require huge number of labour and more time ultimately lead to increase in cost of cultivation. With the increasing industrialization and urbanization, employment opportunities have been increased and acute shortage of labour is often experienced by farmers during field operations.

To overcome the shortage of labour or to perform the field operations at right time and to take the advantage of favorable situation in dry-land conditions, the need of the hour is the dryland mechanization. Dryland mechanization is a process of adoption of need based, location specific, efficient and precision tools, devices, equipment and machines matching to available power source, suitable for local soil, crop and socio economic conditions. Mechanization is the one, most and major factor contributing in reducing cost of cultivation, improving the efficiency of doing work and performing timely field operations with more precision and comfort. Information on various improved tools or machinery for cultivation of groundnut crop is given below in operation wise.

Decorticating equipment

Hand operated decorticator

Hand operated groundnut decorticator (Fig.1) can be used to shell groundnut pods and to separate kernels. It consists of an oscillating sector with sieve bottom and a handle. Number of hard rubber or cat iron lined assemblies are fitted in the oscillating sector unit. The groundnut pods are shelled between the oscillating sector and the fixed perforated concave screen by rubbing action. The decorticated shells and kernels fall down through the perforated concave sieve. The kernel and shells are collected at the bottom of the unit and separated manually. Clearance between the concave and oscillating sector is adjustable to suit the different varieties and concave sieves are also replaceable depending upon the pod size. Its overall dimensions are 600 X 350 X 700 mm. The capacity and efficiency of the unit are 50 kg/h and 98% respectively.

Fig 1: Hand operated groundnut decorticator

Fig 2: Power operated groundnut decorticator

Power operated groundnut decorticator

It is used to shell groundnut pods and to separate kernels. This is operated with 2 H.P single phase electric motor. It consists of feed hopper, rasp bar cylinder with hard rubber linings, perforated concave screen, two oscillating sieves and a blower. The groundnut pods are shelled between the rubber linings of cylinder and fixed perforated concave screen by rubbing action. The decorticated shells and kernels fall down on oscillating sieves through the perforated concave screen. A centrifugal blower with spiral casing provided in between the perforated concave screen and oscillating sieves separates the light weight shells from kernels. Oscillating sieves separates pods from stalk, leaves and other foreign material. Its capacity is 250 – 300 kg/h and its cost is around Rs. 40,000 along with electric motor. (Fig. 2)

Grading equipment

Groundnut kernel grader

It has been established fact that use of small seed of any good variety of groundnut will give similar pod yield as obtained with bold size kernel. Hence groundnut kernel grader will be of great useful to the farmers so that small kernel could be utilized for sowing and bold kernel can be sold for confectionary thus increases income of farmer by 15-20%. A groundnut kernel grader (Fig.3) was developed at Agricultural Research Station, ANGRAU, Anantapur. Three sizes of sieves are provided to this grader for grading of groundnut kernel based on three sizes i.e greater than 1.24 cm, in between 1.06-1.24 cm and less than 1.06 cm. Its capacity is 300 kg/h without any kernel damage and operated with 2 H.P electric motor.

Fig 3: Groundnut kernel grader

Sowing equipment

Ananta four row bullock drawn groundnut planter

To mechanize the sowing operation by using bullocks, a bullock drawn groundnut planter (Fig.5) was designed and developed at Agricultural Research Station, ANGRAU, Anantapur. It is provided with a trough type seed metering mechanism for seed placement in the row. This covers four rows at a time with row to row distance of 30 cm and maintains seed to seed distance of 10 cm in a row at 4-5 cm depth of sowing. The recommended seed rate i.e. 100 kg/ha can be maintained. It can also be used for other crops like Bengal gram, castor and red gram by changing the row to row spacing and disc in seed metering mechanism. The field capacity is in between 1.5 to 2 ha/day. The capacity of hopper is 8 kg for groundnut.

Fig 5: Ananta bullock drawn groundnut planter

Fig 6: Ananta groundnut planter

Ananta tractor drawn groundnut planter

Ananta groundnut planter (Fig.6) is a 8 – row tractor operated groundnut planter with row to row spacing of 30 cm for timely sowing with mechanical advantage and intercropping facility developed at Agricultural Research Station, ANGRAU, Anantapur. This is provided with a hopper and seed metering mechanism as the main components. The hopper is divided into 8 boxes each can accommodate 5 kg of seed (total 40 kg). The inclined plate seed metering mechanism gives correct seed to seed distance of 10 cm in a row and maintains the recommended seed rate of 100 kg/ha with optimum plant population of 33 per square meter area. Placement of seed is at proper depth of 4-5 cm. The seed damage is negligible and the field capacity is 6 to 7 ha/day and facilitates coverage of large area before the soil moisture is dried up. A 5 cm width covering blade is also attached behind the furrow openers to cover the furrows opened after seed placement. The intercropping of redgram or castor can also be possible using Ananta planter along with groundnut sowing. The spring type cultivator frame of this planter facilitates to work even in stony soils. The cost of Ananta planter is approx. Rs.55, 000.

Intercultivation equipment

Ananta bullock drawn inter-cultivation implement

It is a 4 – row bullock drawn inter-culture implement used for removal of shallow depth weeds in between rows of groundnut crop. It consists of 4 straight blades, frame, handle and beam to attach with a pair of bullocks. The blades are fixed to the frame to which handle is attached. The blades are the working components which are made from medium carbon steel or mild steel for more strength to resist soil friction and to have long life. The width of each blade is 15 cm. For operation, the weeder is passed in between the rows of crop so the blades cut and uproot the weeds. Its field capacity is 1.5 – 2.0 ha/day. (Fig.7)

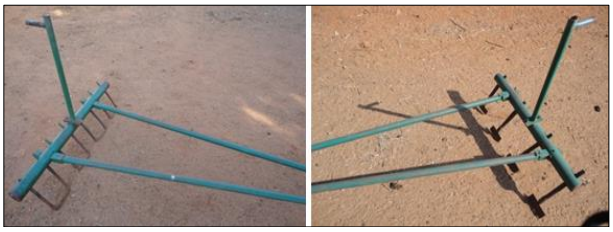

Fig 6: Bullock drawn inter-cultivation implements for groundnut

Ananta tractor drawn inter-cultivation implement

This is a 8-row tractor operated inter-culture implement used for weeding in groundnut crop developed at Agricultural Research Station, ANGRAU, Anantapur. Its frame is provided with 8 tynes, each tyne attached with T or V-shape sweeps to work in between 30 cm row spacing of the crop without any plant damage. Two small width pneumatic tyres of 8.3" X 28" size need to be fitted to the rear axle of the tractor to run in between rows of the crop instead of normal size tyres to prevent trampling of plants under the tyres. The size of the sweeps range from 4" to 6". The cost of inter-culture implement and pneumatic tyres with sweeps is approx. Rs.45,000. Its field capacity is 4 to 5 ha/day. (Fig.8)

Fig 7: Ananta tractor drawn inter-cultivation implement

Harvesting equipment

ANGRAU blade guntaka

ANGRAU blade guntaka (Fig.13) designed and developed at Agricultural Research Station, ANGRAU, Anantapur is used for digging of groundnut crop after maturity at the soil moisture range of 8-15%. It is provided with main components frame, 3-point linkage and a straight blade. All the components are made of MS material. The blade is the working component for digging of crop and its length and width are 135 and 8 cm respectively. It has the working width of 135 cm and covers 4-rows of groundnut crop (row to row spacing 30 cm) at a time. Depth of digging is 8-10 cm and covers 4-5 ha in a day at the recommended speed of operation of 2-3 km/h. The digging efficiency is 90-95%.

Fig 8: ANGRAU blade guntaka

Groundnut digger, shaker cum windrower

It is also used for harvesting of groundnut crop at soil moisture levels of 8-15% and operated with above 45 H.P tractor. It has the working width of 120 cm and covers 4 rows of groundnut crop at row to row spacing of 30 cm. Its overall dimensions are 1700 x 1000 x 1050 mm provided with soil loosening tool of sweep type, a pick conveying mechanism

and gatherer windrower. The soil engaging tool is made of high strength mild steel. At the rear, a gatherer windrowers the conveying crop. While conveying, soil get removed from crop due to shaking action. The field capacity is 0.8-1.0 ha/h at the recommended speed of operation 2-3 km/h. Harvesting and soil separation efficiencies are 96 and 95% respectively. Saving in labour cost and time are 50 and 95% respectively compared to manual harvesting. Its cost is about Rs.1, 80,000. (Fig.16).

Fig 9: Groundnut digger, shaker cum windrower

Threshing equipment

Fresh pod thresher

It is a throw-in type thresher used for separating pods form plants immediately after harvesting of groundnut crop. The farmer no needs to wait for drying of crop after harvesting for threshing. It is operated with PTO shaft (speed 540 RPM) of 35-45 H.P tractors. It consists of frame, feed hopper, drum type threshing cylinder, concave, oscillating sieves and a blower. Total construction sits on the main frame. The threshing cylinder has the diameter and length of 50 cm and 90 cm respectively and working speed of 320 RPM. The cylinder surface is provided with flat pegs arranged in 6 rows such that each row has 7-8 pegs (length of peg 10 cm). A concave is provided under the threshing cylinder for rough separation of pods and stripped plants. An outlet is provided at the rear portion of cylinder for stripped plants. In order to separate all the unwanted material after threshing from the pod, two sieves have been provided below the concave. The top sieve has holes of 50 X 17 mm size and the bottom sieve has holes of 25 X 9 mm size. A centrifugal blower with spiral casing has been provided in between the two cleaning sieves for blowing of light weight plant material coming along with threshed pods from the concave. It has the feed rate of 750 kg/h and output capacity of 300 kg/h with 96% threshing efficiency. It is very useful where the influence of north east monsoon will be more and continuous rains occur at harvesting time. Initial cost is around Rs. 1, 80,000. It can easily transported from one place to another place as it is provided with pneumatic tyres. (Fig.18)

Fig 10: Fresh pod thresher for groundnut Fig.19: Dry pod thresher for groundnut

Dry pod thresher

This is also a throw-in type thresher for groundnut crop having moisture content of 15-17%. Crop harvested needs to be dried before threshing. It is operated either with 10 H.P diesel engine or electric motor. It consists of frame, feed hopper, hammer type threshing cylinder, concave, oscillating sieves and a blower. A concave is provided under the threshing cylinder for rough separation of pods and stripped plants. In order to separate all the unwanted material after threshing from the pod, two sieves have been provided below the concave. A centrifugal blower with spiral casing has been provided in between the two cleaning sieves for blowing of light weight plant material coming along with threshed pods from the concave. It has the feed rate of 500 kg/h and output capacity of 200 kg/h with 95% threshing efficiency. Its Initial cost is around Rs. 1, 10,000 including 10 H.P diesel engine. (Fig.19)

Comparison between mechanical and farmers practice of groundnut cropping system

Table 1: Economic evaluation of mechanization over traditional farmers practice in groundnut cropping system

S. No.	Field operations	Mech. Operations (Rs/ha)	Farmers practice (Rs/ha)
1.	Seed cost	3000	3750
2.	Sowing	875	1250
3.	Inter	375	500
4.	cultivation	1200	1200
5.	Intra weeding	1200	1200
6.	Fertilizers and pesticides Harvesting and threshing	1500	3250
	Total	8150	11150

The cost of cultivation in groundnut can be reduced by Rs. 3000 per hectare by using improved tools and machinery against traditional practices. As such 25% of cultivation expenses could be reduced only by mechanization to the dryland farmers.

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