

Impact of Ridge and Furrow System of planting on Groundnut yield attributes in Chittoor District of Andhrapradesh, India

ABSTRACT

Climate change is placing a growing strain on the land and natural resources that India's farmers rely on, not just to provide food for the country, but to also sustain livelihoods. At present, some 30 percent of land is experiencing degradation, and rising temperatures means agriculture needs 30 percent more water. Innovative methods are emerging across India to help farmers adapt to the pressures stemming from climate change and to mitigate the impacts of their farming methods. An innovative ridge and furrow planting pattern and its impact on ground nut crop production was carried out. The field experiment was conducted during the two consecutive Rabi and Kharif seasons of 2020 and 2021 to study ridge and furrow in-situ conservation system for Groundnut crop at farmer's fields in Chittoor district of Andhra Pradesh under Southern agro-climatic region. Raised bed planting involves sowing of crops using raised bed maker alternated with furrows for irrigation. Bed width depends upon crop spacing usually ranging from 30 cm, and accommodates crop on raised bed. Raised beds require reshaping each year preferably before Kharif season. Bed planting reduces cost, and saves seed, fertilizer and irrigation water. It also increases water-use efficiency both under rainfed and irrigated scenarios because water moves laterally from furrows into beds thereby reducing evaporation losses. Further lesser incidence of pest and diseases as well as better aeration within furrows. Weed population reduced on ridge and furrow method of planting. The ridge-furrow method of planting groundnut has been reported to save seed and water by 25-30% and fertilizer by 25%, yield enhancement to the extent of 8-23% higher compared to the normal flatbed sowing method. Economic analysis revealed that the net profit was recorded higher under ridge and furrow system compared to normal flatbed sowing. **B: C** ratio was recorded under ridge and furrow system (5.13) while under flat sowing system (2.20) for the consecutive years respectively.

Keywords: Climate change, agriculture, irrigation water, groundnut

Introduction

The groundnut, also called peanut or monkey nut, is a legume which originated in South America. It spread through colonial Portuguese influence to Brazil, southern Bolivia and then to northwestern India in the 1500s. The Portuguese colonists introduced the plant to Africa from where it was introduced into North America. India received the crop during the first half of the 16th century from one of the Pacific islands near China where it was introduced earlier from either Central America or South America. The groundnut is called the 'king of oilseeds' due to

its high oil content. It is also known as the 'wonder nut' or the 'poor man's cashew nut'. Groundnut is an important oilseed crop grown in India. Globally India ranks first in area and second in production. India, accounts for 31 % of the total groundnut area in the world with 26.4 Mha with a total production of 37.1 million MT. The average productivity is 1400 kg/ha. The annual global export of groundnuts is of two million MT valued at 2,600 million US \$. (Source: Indian Oilseeds and Produce Export Promotion Council, 2018). Groundnut crop in India are mainly grown in certain states like Gujarat, Andhra Pradesh, Tamil Nadu Karnataka and Maharashtra. The state of Andhra Pradesh has about one-third of the acreage of groundnut crop is cultivated in an area of 6.66 lakh ha in India and is in the third in position by contributing 17 per cent of the whole production. Total ground nut production in India accounts for 9.18 MT and Andhra Pradesh accounts for 1.04 MT (source: Apeda.gov.in, 2018). The productivity of ground nut stands at 883 kg/ha for Andhra Pradesh. The irrigated area of groundnuts in the state has risen from 12.4 lakhs hectares in 1955-56 to 17.66 lakh hectares in 2018-19 and the production has increased from 10.7 lakh tons in 1955-56 to 104 lakh tons in 2018-19 (Source: Season and crop report of A.P. 2018-19).

In Andhra Pradesh it is mainly cultivated in Rayalaseema districts viz., Anantapur, Cuddapah, Kurnool, Chittoor districts and some mandals of Nellore district. Anantapur district ranks first in Andhra Pradesh in terms of area of acreage at 7.64 lakh ha followed by Chittoor district accounts 1, 89, 000 hectares and production of groundnut crops at Anantapur 7.5 lakh tones and Chittoor district stands at 1, 31,000 tons while the productivity levels of groundnut crop in Anantapur district stood at 992 Kg per ha the district was 2696 kg per hectare (source: Season and crop report of AP, 2018-19). The average annual rainfall in Chittoor district assured 848 mm per annum. The rainfed agriculture suffers from a number of hydro physical and socio-economic constraints, which affect the productivity of rainy and post-rainy season crops. These include erratic and undependable rainfall, excess and deficient moisture with in a season, harsh thermal regime, soil loss, low level of input use and technology adoption and resource poor farmers (Gupta, 2002). Groundnut is a major oilseed crop grown during the Kharif season in the rain fed areas of Southern India. The flat-land cultivation system is popular in various Agro-climatic zones of Andhra Pradesh state. The crop experiences moisture stress during the dry spell ranging from 15 to 21 days at any growth stage under rainfed conditions, resulting significant reduction in the yield and excess rainfall leads to prevalence of a range of pests and diseases. At present for

extensively cultivation of Kharif crop like groundnut which faces the problem of water logging and poor aeration thereby affecting crop productivity adversely. The early phase of pod setting is especially sensitive to any soil moisture deficit and this reflects on decreased pod weight. Very often rain fed groundnut crop experiences soil moisture stress when rains fail during the monsoon season. Excess and continuous rains may create bad drainage and restricts aeration, which results in non-availability of plant nutrients and poor microbial activities.

Ram et al., (2011) revealed that ridge and furrow sowing of soybean should be advocated over flatbed sowing mainly due to their ability to save irrigation water. Kumari and Rao (2005) reported that the crop growth rate and net assimilation rate were higher when crops are planted on ridge and furrow or bed planting system for mustard. Jadhav et al., (2012) and Dhakad et al., (2014 and 2015) found higher growth parameters, yield and yield attributes parameters in ridge and furrow system over flat sowing system in soybean. Similar trends reported by Bhargav et al., (2013). In view of the above findings and its importance in soil moisture conservation, reduced cost of cultivation the study was undertaken. Climate change is placing a growing strain on the land and natural resources that India's farmers rely on, not just to provide food for the country, but to also sustain livelihoods. At present, some 30 percent of land is experiencing degradation, and rising temperatures means agriculture needs 30 percent more water. Innovative methods are emerging across India to help farmers adapt to the pressures stemming from climate change and to mitigate the impacts of their farming methods. An innovative method of Ridge and furrow cultivation and its impact on growth and yield of groundnut crop in Chittoor district of AP.

Materials and Methods

The field experiment was conducted at the farmer's fields in Chittoor district of Andhra Pradesh during Kharif and Rabi seasons 2020 and 2021. The field study was performed with ridge and furrow system. Ridge and furrows were prepared with the help of tractor and to make the ridge and furrow system an extra punji is attached on the back tines of tractor operated seed-cum-fertilizer drill machine. The width of punji depends upon the row to row distances. Sowing seeds by front line tines and covering them by soil took place by punji attached in back line tines. Thus lines of groundnut automatically come over ridge favored by formation of alternate furrows. This ridge and furrow system involves sowing of crop at a row spacing of 30 cm and 10 cm between crops in red soil. The average rainfall of 526.6 mm and 639.2 mm received during the year 2020

and 2021 respectively. The Ground nut crop (variety Kadiri-1812) was sown for the study. The recommended dose of fertilizers (25:50:0 NPK kg/ha). The plant growth character and yield contributing data such as are plant height, root length, number of root nodules per plant, number of pods per plant, number of seeds per pod, seed yield per plant, seed yield , straw yield, water use, pest and disease incidence were recorded of groundnut crop for sown by ridge and furrow system and flat sowing.

Harvest index is the ratio of economic yield (kg/ha) to biological yield (kg/ha) and multiplied by 100 to obtain its value in percentage. It indicates the efficiency of plant material to convert the photosynthetic in to the economic yield and it is worked out as:

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (kg/ha)}}{\text{Biological yield (kg/ha)}} \times 100 (1)$$

Where, the biological yield = Seed yield + Straw yield

Water Use Efficiency (WUE) is defined as the amount of carbon assimilated as biomass or grain produced per unit of water used by the crop.

$$\text{Water use efficiency (WUE)} = \frac{\text{Dry matter production (kg/ha)}}{\text{ET (in mm)}}$$

Economic analysis

Cost of cultivation

The cost of cultivation (Rs/ha) of each treatment was worked out by considering the price of inputs, charges for cultivation, labour and other charges.

Gross monetary returns

The gross monetary returns (Rs/ha) occurred due to different treatments in the present study were worked out by considering market prices of economic product, by product and crop residues during the experimental year.

Net monetary returns

The net monetary returns (Rs/ha) of each treatment were worked out by deducting the mean cost of cultivation of each treatment from the gross monetary returns gained from the respective treatments.

Benefit: Cost ratio

The benefit: cost ratio of each treatment was calculated by dividing the gross monetary returns by the mean cost of cultivation

Results and Discussion

Table 1 Growth character and yield attributes of groundnut

Parameter	Flat bed method of planting (acre)	Ridge and furrow method of planting (acre)
Seed rate (Kg)	45	28
Plant population (No./m ²)	54- 60	44
Number of root nodules per plant at 60 DAS	60-70	90-100
Number of pods per plant	45-50	65-70
Seed yield weight per plant (g)	51.75-57	78-84
Seed yield (kg/acre)	1240	2080
Straw yield (kg/acre)	1820	1956
Harvest index (%)	40.52	51.53
Water use efficiency	0.50	0.70
Pest and Disease incidence	20-25%	5-10%
Yield		
Cost of cultivation	28,150	24,300
Gross monetary returns	62,000	1,04,000
Net monetary returns	33,850	83,730

Growth and yield attributing characteristics of groundnut are presented in Table 1 which revealed that the plant growth and yield parameters were found better in ridge and furrow system as compared to normal flatbed sowing. It's due to proper drainage of excess rainfall through furrows. It also increases water-use efficiency both under rainfed and irrigated scenarios because water moves laterally from furrows into beds thereby reducing evaporation losses. The plant population/m² ranged 8-13 % higher on planting groundnut using ridge and furrow as compared to planting on flat land with normal seed drill. The lowest number of root nodules per plant was recorded under flatbed sowing; however, the highest number of root nodules per plant was

produced under ridge and furrow system. The highest productivity of 2080 kg/acre observed in the ridge and furrow system where as it was found lowest under normal. Further lesser incidence of pest and diseases as well as better aeration within furrows. Weed population reduced on ridge and furrow method of planting. The ridge-furrow method of planting groundnut has been reported to save seed and water by 25-30% and fertilizer by 25%, yield enhancement to the extent of 8-23% higher compared to the normal flatbed sowing method. Similar results were reported by Basediya et al. (2018).

Table. 2 Economics analysis of soybean production

Parameter	Flat bed method of planting	Ridge and Furrow method of planting
Land preparation	2,800	3,600
Seed	6,750	4,200
Organic fertilizers	1,500	2,800
Sowing	1,600	1,200
Weed management and Intercultivation	2,500	1,000
Pesticides	4,000	1,600
Fertilizers	1,500	670
Harvesting and Threshing	7,500	5,200
Total cost of cultivation	28,150	20,270
Yield in bags (40 kg per bag)	31	52
Price per bag	2,000	2,000
Benefit: cost ratio	2.20	5.13
Gross monetary returns	62,000	1,04,000
Net monetary returns	33,850	83,730

Economic analysis of groundnut is presented in Table 2. It reveals that higher net return of Rs. 83,730 per ha with **B: C** ratio of 5.13 is recorded in ridge and furrow system whereas, the lowest net return of Rs 33,850 per ha with and **B: C** ratio of 2.20 was recorded under normal flatbed sowing for year 2020-21 and same trends observed during year 2021-22. Similar results reported by Bhargav *et al.*, (2013), Dhakad *et al.*, (2014 & 2015) and Basediya et al., (2018) . They concluded that the higher gross as well as net monetary returns were recorded under ridge and furrow planting as compared conventional system.

Conclusion

On the basis of this study, the better results of two consecutive years were found in ridge and furrow planting system of groundnut on the growth and yield characters as compared to conventional method of sowing i.e. normal flatbed sowing. It is concluded that ridge and furrow method of sowing should be advocated over flatbed sowing mainly due to the soil moisture stored sustains the crop during dry spells, reduced weed population, save seed and water, lesser incidence of pest and diseases as well as better aeration within furrows.

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