

Assessment of Farm Mechanization Level for Groundnut Crop in Junagadh District

ABSTRACT

Groundnut (*Arachis hypogaea L.*) is a major leguminous crop grown in tropical and sub-tropical regions worldwide. This study was conducted in Junagadh district of Gujarat state. Total 45 villages from 9 talukas were selected randomly. A total of 450 farmers were selected for survey with 10 farmers chosen from each village. The data from the respondents was personally collected by interviewing them with the help of a well-structured interview schedule and it was statistical analyzed. The findings revealed that 57 % of respondents belonged to middle age group, 27 % of the respondents were educated up to medium school level, 72 % of respondents had a medium size of family, 41% of the respondents had medium sized land holdings, 36 % of the respondents had well source of irrigation, 79 % of the respondents had electric pump and 31 % of the respondents had tractor. Majority of respondents used tractor drawn for seed bed preparation cultivator (70 %), blade harrow 70 % and planker 70 %. 46 % of respondents used tractor drawn auto-seed cum fertilizer drill (after monsoon) for sowing, 66 % of respondents used mini tractor drawn multipurpose implement for interculturing, 98 % of respondents used battery sprayer for plant protection, 67 % of respondents used tractor drawn blade harrow for harvesting, 99.56 % of respondents used electric or oil engine operated thresher for threshing in Junagadh district. Mean of mechanical energy for different operations such as seedbed preparations, sowing, interculturing, plant protection, harvesting and threshing was found to be 4419.5, 1543.20, 348.49, 131.98, 1072.33 and 658.62 MJ/ha respectively in Junagadh district. Survey represent that the mean farm power is 45.05 hp and farm mechanization level is 13.92 hp/ha in Junagadh district.

Keywords: Groundnut, Farm machinery, Mechanical energy, Farm power, Farm mechanization level

1. INTRODUCTION

Groundnut (*Arachis hypogaea L.*), also known as earthnut, monkey nut, pinda, manillanut and goobers (Woodroof, 1983)^[1]. India is the second largest producer of groundnuts in the world. Globally groundnut is 4th most important edible oil source and 3rd most important source of vegetable protein (Harisudhan and Subrahmaniam, 2020)^[2].

Groundnut kernels contain 43 to 49 % of oil, 28 to 30 % of proteins which is 1.3 times higher than meat, 2.5 times higher than eggs and 8 times higher than fruit and 16 to 24 % of carbohydrates. They are rich source of vitamins A, B1, B2 and E(Lakhani and Vagadia, 2023^[3]; Sinhar and Gajjar, 2023^[4]).Gujarat, being a prominent state, accounts for 37 % of the total production in India (Anon., 2023a)^[5]. Within Gujarat, Junagadh district is the leading producer of peanuts, with a production of 0.45 million tonnes and an 11 % share, second only to Rajkot (12 %, 0.49 MT) during the Kharif season of 2020-21 (Anon., 2023b)^[6]. Gujarat cultivated areas of groundnut is 19.09 lakh hectares with an annual production of 3.85 MT and productivity of 2020 kg/ha (Anon., 2021)^[7].

Farm mechanization implies the use of various power sources and improved farm tools and equipment, with a view to reduce the drudgery of the human beings and draught animals, enhance the cropping intensity, precision and timelines of efficiency of utilization of various crop inputs and reduce the losses at different stages of crop production. Therefore, there is a greater need to adopt new farm machinery or to improve the existing farm machinery in groundnut cultivation (Lakhani *et al.*, 2024)^[8].

This study would eventually give insight into the existing scenario of farm mechanization status in groundnut crop and analyzes extent of awareness, knowledge and adoption of different farm implements by groundnut farmers.

Keeping this in view, the present study was carried out with the following objectives:

1. To study the profile of groundnut growers and machinery used by them for different operation of groundnut crop
2. To assess the mechanical energy used in different farm operations for groundnut crop

2. METHODOLOGY

The present study was undertaken in Junagadh district of Gujarat state. Geographically, it extends between latitudes 20.47°N to 21.45°N and longitudes 70.15°E to 70.55°E, encompassing a total land area of 8,831 km². Total 45 villages from 9

talukas were selected randomly. A total of 450 farmers were selected for survey and 10 farmers chosen from each village. The data from the respondents was personally collected by interviewing them with the help of a well-structured interview schedule. Comprehensive interview schedule was developed to collect data on personal characteristics of farmers, adoption of farm machinery, time and fuel consumption and constraints faced by farmers. The data was analyzed to calculate mechanical energy, level of farm mechanization and to identify constraints faced by farmers. The study used percentage, frequency and arithmetic mean statistical tools to analyze the data.

3. RESULTS AND DISCUSSION

3.1 Profile of Groundnut Growers

The distribution of farmers according to their groundnut grower profiles is shown in table 1 as per following order. The percentage of respondents belongs to middle age, young and old age groups was 57 %, 11 % and 32 % respectively, middle education, college/post-graduation, higher education, primary education, illiterate and functionally literate were 27 %, 15 %, 21 %, 19 %, 11 % and 7 % respectively, medium size, small size and large size of family members were 72 %, 14 % and 14 % respectively, medium size, big size, marginal size, small size and semi medium size of land holding were 40 %, 2 %, 8 %, 19 % and 31 % respectively, source of irrigation wells, bores, no facility and well or bore (both) were 36 %, 28 %, 0.44 % and 36 % respectively, electrical pump, submersible pump, Electric & Submersible pump and no facility of irrigation power were 79 %, 10 %, 11 % and 0.22 % respectively, mini tractor, 35 hp tractor, 45 hp tractor and more than 45 hp tractor was around 29 %, 31 %, 22 % and 18 % respectively. These findings were in line with findings of Zala *et al.* (2021)^[9], Rathod *et al.* (2022)^[10] and Zala *et al.* (2023)^[11].

3.2 Adoption Pattern of Farm Machinery by the Groundnut Grower

The distribution of farmers according to adoption pattern of farm machinery is shown in table 2 as per the following order. Seed bed preparation are carried out by tractor drawn M. B plough 46 %, cultivator 70 %, blade harrow 70 %, plunger 70 % and rotavator 34 %. Some few farmers adopted mini tractor drawn cultivator 27 %, blade harrow 25 % and plunger 22 %. Bullock drawn implements, the great majority of farmers used cultivator 11 %, blade harrow 15 % and plunger 16 %. Tractor drawn seed cum fertilizer drill (before monsoon) 46 %, tractor drawn seed cum fertilizer drill (after monsoon) 16 %, mini tractor drawn seed cum fertilizer drill (after monsoon) 15 % and bullock drawn auto seed cum fertilizer drill (after

Comment [A1]: Is there no other more generalized term internationally? I searched online, I think they are districts. But I don't know if they are or not.

monsoon) 13 % are commonly used for sowing of groundnut crop. For interculturing purpose, the great majority of farmers are used manually 100 %, mini tractor drawn multipurpose implement 66 % and few farmers used bullock drawn multipurpose implement 22 % for groundnut crop. Majority of farmers used battery sprayer 98 %, few farmers are used knapsack sprayer 2 % and tractor drawn power sprayer 10 % for plant protection. In harvesting the majority of farmers are used manually 100 %, tractor drawn blade harrow 67 %, mini tractor drawn Blade harrow 20 % for groundnut crop. Majority of farmers are used electric or oil engine operated thresher 99.56 % for groundnut crop. Raval *et al.* (2003) ^[12] also reported similar finding.

Table 1: Distribution of respondents according to groundnut grower profile(n=450)

	Parameter	Percentage (%)	Frequency
Age	Young (up to 35 years)	11	49
	Middle (36 to 50 years)	57	256
	Old age (above 50 years)	32	145
Education	Illiterate	11	51
	Functionally literate	7	31
	Primary school	19	85
	Middle school	27	122
	High school	21	92
	College/ Post graduation	15	69
Family Size	Small (up to 3)	14	61
	Medium (4 to 6)	72	324
	Large (above 6)	14	65
Land Holding (ha)	Big size (above 10 ha)	2	7
	Medium size (4.01 to 10 ha)	40	181
	Semi medium size (2.01 to 4 ha)	31	140
	Small size (1.01 to 2 ha)	19	86
	Marginal size (0.01 to 1 ha)	8	36
Source of Irrigation	No facility	0	2
	Well	36	164
	Bore	28	124
	Well & Bore (both)	36	160
Irrigation Power	No facility	0	1
	Diesel engine pump	0	1
	Electric pump	79	356
	Submersible pump	9	40
	Electric pump&Submersible pump (both)	12	52
Tractor available	Mini tractor	29	129
	Up to 35 hp	31	141
	Up to 45 hp	22	97
	More than 45 hp	18	82

Table 2: Distribution of respondents according to adoption pattern of farm machinery (n=450)

Sr. No.	Adoption pattern	Percentage(%)	Frequency
1.	Seed bed preparation		
	A. Tractor drawn		
	1. M. B. Plough	46	206
	2. Cultivator	70	317
	3. Blade harrow	70	317
	4. Planker	70	313
	5. Rotavator	34	155
	B. Mini tractor drawn		
	1. Cultivator	27	122
	2. Blade harrow	25	111
	3. Planker	22	99
	C. Bullock drawn		
	1. Cultivator	11	51
	2. Blade harrow	15	69
	3. Planker	16	70
2.	Sowing		
	1. Tractor drawn seed cum fertilizer drill (after monsoon)	16	73
	2. Tractor drawn seed cum fertilizer drill (before monsoon)	46	209
	3. Tractor drawn seed drill (after monsoon)	7	32
	4. Tractor drawn seed drill (before monsoon)	1	5
	5. Mini tractor drawn seed cum fertilizer drill (after monsoon)	15	69
	6. Bullock drawn auto seed cum fertilizer drill (after monsoon)	13	57
	7. Bullock drawn hand metering seed drill (after monsoon)	1	5
3.	Inter-culturing		
	1. Mini tractor drawn multipurpose implement	66	295
	2. Bullock drawn multipurpose implement	22	100
	3. Manually	100	450
4.	Plant protection		
	1. Tractor Drawn Power Sprayer	10	46
	2. Knapsack Sprayer	2	7
	3. Battery Sprayer	98	443
5.	Harvesting		
	1. Tractor drawn groundnut digger-shaker	0	2
	2. Tractor drawn blade harrow	67	301
	3. Mini tractor drawn Blade harrow	20	88
	4. Manually	100	450
6.	Threshing		
	1. Tractor operated thresher	0.45	2
	2. Electric or oil engine operated thresher	99.55	448

3.3 MECHANICAL ENERGY:

Mechanical energy for various farm operations using various power sources such as tractors, bullocks, and human power.

Figure 1 illustrates the greatest mechanical energy of 979.62 MJ/ha in vanthali taluka and the minimum mechanical energy of 865.83 MJ/ha in mendarda taluka during the M. B. plough operation. Regarding other agricultural activities, the maximum mechanical energy used for a cultivator is 357.15 MJ/ha in vanthali taluka and the minimum mechanical energy is 331.15 MJ/ha in manavadar taluka, for a blade harrow the maximum mechanical energy consumed is 402.55 MJ/ha in vanthali taluka and the minimum mechanical energy consumed is 366.76 MJ/ha in keshod taluka, for a planker the maximum mechanical energy consumed is 272.20 MJ/ha in bhesan taluka and the minimum is 241.57 MJ/ha in manavadar taluka, for rotavator, the maximum mechanical energy consumed is 990.34 MJ/ha in vanthali taluka and the minimum energy consumed is 904.50 MJ/ha in maliyahatina taluka.

According to figure 2, when the cultivator is operating, the highest mechanical energy in bhesan taluka is 549.93 MJ/ha, while the minimum mechanical energy in manavadar taluka is 518.94 MJ/ha. The maximum mechanical energy used for a blade harrow in the keshod taluka is 576.26 MJ/ha, while the minimum mechanical energy used in the mendarda taluka is 544.43 MJ/ha with regard to other farm operations. According to planker, the lowest mechanical energy used is 275.27 MJ/ha in maliyahatina taluka and the largest is 288.58 MJ/ha in vanthali taluka.

According to figure 3, when the cultivator is operating, the maximum mechanical energy in bhesan taluka is 75.38 MJ/ha, while the minimum mechanical energy in mendarda taluka is 52.78 MJ/ha. The maximum mechanical energy used for a blade harrow in keshod taluka is 65.84 MJ/ha, while it is not utilized in mangrol taluka. Similarly, for a planker, the maximum mechanical energy used is 75.38 MJ/ha in mangrol taluka and the minimum mechanical energy used in mendardataluka is 57.28 MJ/ha.

Figure 4 illustrates the tractor drawn seed cum fertilizer drill operation (before monsoon) at the maximum mechanical energy of 341.72 MJ/ha in visavadar taluka and the minimum mechanical energy of 324.62 MJ/ha in Junagadh rural taluka. The maximum mechanical energy consumed by other tractor drawn seed cum fertilizer drills (after monsoon) is 387.05 MJ/ha in mendarda taluka and the minimum mechanical energy is 322.50 MJ/ha in bhesan taluka. The maximum mechanical energy consumed by tractor drawn seed drill (before monsoon) is 380.58 MJ/ha in visavadar taluka, while in vanthali, manavadar, mendarda, bhesan, and keshod taluka, it is not utilized. Tractor drawn seed drill (after monsoon) in keshod taluka the maximum mechanical energy is 337.84 MJ/ha, while in maliyahatina taluka the minimum mechanical energy is 317.09 MJ/ha. A mini tractor

drawn seed cum fertilizer drill (after monsoon) in Junagadh rural taluka, the maximum mechanical energy is 282.54 MJ/ha, while in mendarda taluka the minimum mechanical energy is 270.31 MJ/ha. Bullock drawn auto seed cum fertilizer drill (After monsoon) the maximum mechanical energy is 89.16 MJ/ha in keshod taluka and the minimum mechanical energy is 85.81 MJ/ha in mangrol taluka and bullock drawn hand metering seed drill (after monsoon) the maximum mechanical energy is 87.94 MJ/ha in keshod taluka while in vanthali, manavadar, mangrol, bhesan, maliyahatina, visavadar and keshod taluka, it is not utilized.

Fig. 5 shows the maximum mechanical energy of 195.24 MJ/ha in keshod taluka and the minimum mechanical energy of 174.86 MJ/ha in maliyahatina taluka during mini tractor drawn multipurpose implement. For other bullock drawn multipurpose implement the maximum mechanical energy consumed is 90.03 MJ/ha in manavadar taluka and the minimum mechanical energy 78.70 MJ/ha in vanthali taluka, manually the maximum mechanical energy is 86.94 MJ/ha in manavadar taluka and the minimum mechanical energy 76.06 MJ/ha in vanthalitaluka and tractor drawn multipurpose implement is not used in any taluka.

Fig. 6 shows the maximum mechanical energy of 139.75 MJ/ha in bhesan taluka and the minimum mechanical energy of 105.06 MJ/ha in Junagadh rural taluka during tractor drawn power sprayer. In manavadar taluka the maximum mechanical energy consumed by knapsack sprayers is 11.03 MJ/ha while in bhesan, Junagadh rural, maliyahatina, mendarda, and keshod taluka, this energy is not utilized. The manavadar taluka has a maximum mechanical energy of 11.36 MJ/ha for battery sprayers, while the keshod taluka has a minimum mechanical energy of 10.54 MJ/ha.

Fig. 7 illustrates the tractor drawn blade harrow maximum mechanical energy of 487.53 MJ/ha in mendarda taluka and minimum mechanical energy of 441.64 MJ/ha in Junagadh rural taluka. The other mini tractor drawn blade harrow has a maximum mechanical energy of 424.32 MJ/ha in manavadar taluka and a minimum mechanical energy of 401.17 MJ/ha in vanthali taluka. Manually, mendarda taluka has the maximum mechanical energy is 58.85 MJ/ha, while vanthali taluka has the minimum mechanical energy is 47.22 MJ/ha. The tractor drawn groundnut digger-shaker has a maximum mechanical energy of 757.33 MJ/ha in bhesan taluka and is not utilized in vanthali, manavadar, mangrol, maliyahatina, visavadar, mendardar and keshod taluka.

The mechanical energy of an electric or oil engine operated thresher is shown in fig. 8 at the maximum mechanical energy of 583.42 MJ/ha in Keshod taluka and the minimum mechanical energy of 524.78MJ/ha in Mangrol taluka. In Mangrol taluka, the maximum mechanical energy of tractor-operated thresher is 972.28 MJ/ha, it is not utilized in vanthali, manavadar, bhesan, junagadh rural, maliyahatina, visavadar, mendarda, and keshod taluka.

3.4 Farm Mechanization Level Considering Tractor Power, Animal Power and Human Power

There is huge role of tractor for improvement of farm mechanization level as tractor allow farmers to do heavy duty works easily and time consuming. According to tables 1 and 2, the maximum mean farm mechanization level inmanavadar taluka is 15.55 hp/ha whereas the maximum mean farm power in mendarda taluka is 47.87 hp. According to tables 1 and 2, the mean minimum farm mechanization level in bhesantaluka is 12.72 hp/ha whereas the minimum mean farm power in vanthali taluka is 40.69 hp.

According to the survey the Junagadh districtof 450 farmers has a mean farm power of 45.05 hp and a farm mechanization level of 13.92 hp/ha.

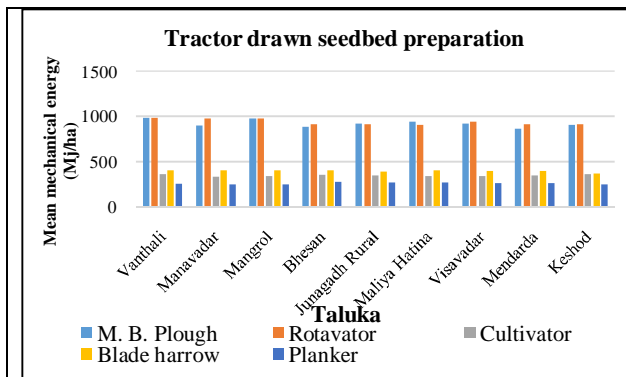


Fig. 1 Mechanical energy of tractor drawn implements used for seedbed preparation by 40 farmers in Junagadh district

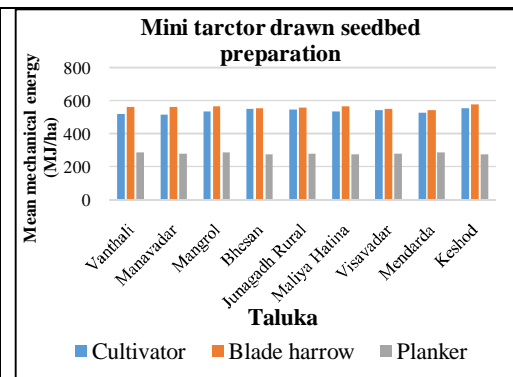


Fig. 2 Mechanical energy of mini tractor drawn implements used for seedbed preparation by 40 farmers in Junagadh district

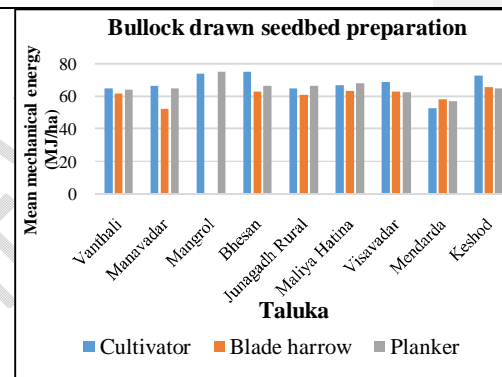


Fig. 3 Mechanical energy of bullock drawn implements used for seedbed preparation by 40 farmers in Junagadh district

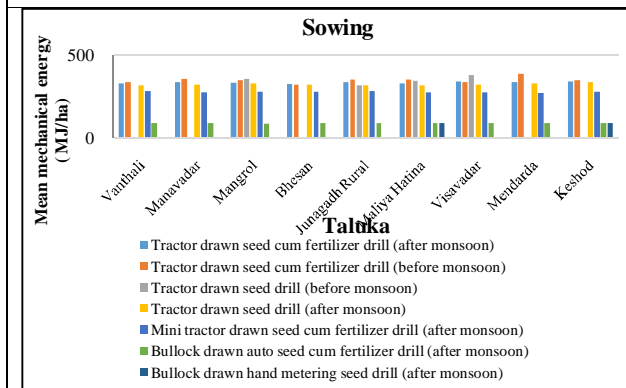


Fig. 4 Mechanical energy of implements used for sowing by 40 farmers in Junagadh district

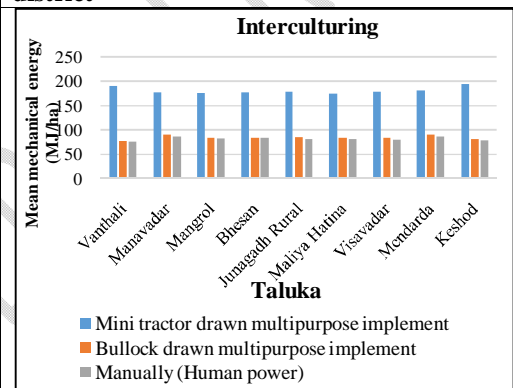


Fig. 5 Mechanical energy of implements used for interculturing by 40 farmers in Junagadh district

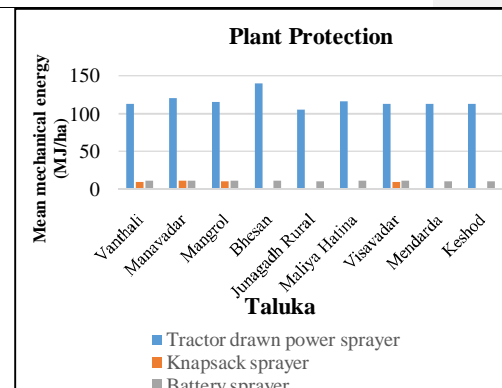


Fig. 6 Mechanical energy of implements used for plant protection by 40 farmers in Junagadh district

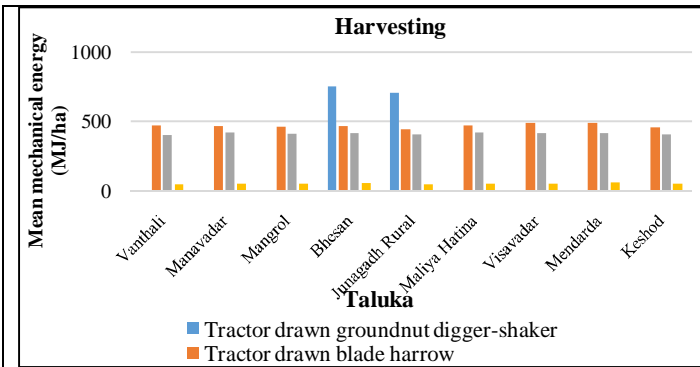


Fig. 7 Mechanical energy of implements used for harvesting by 40 farmers in Junagadh district

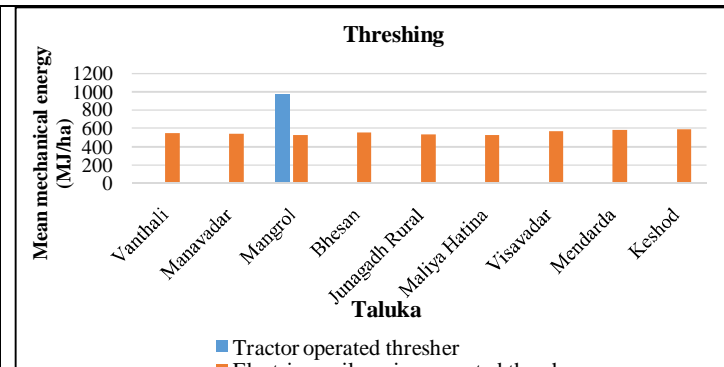


Fig. 8 Mechanical energy of implements used for threshing by 40 farmers in Junagadh district

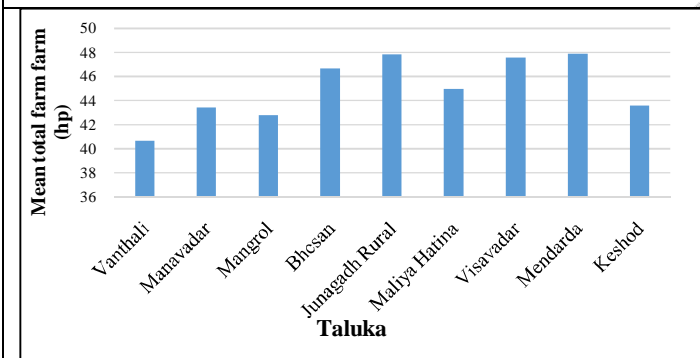


Fig. 9 Total farm power of 450 farmers in Junagadh district

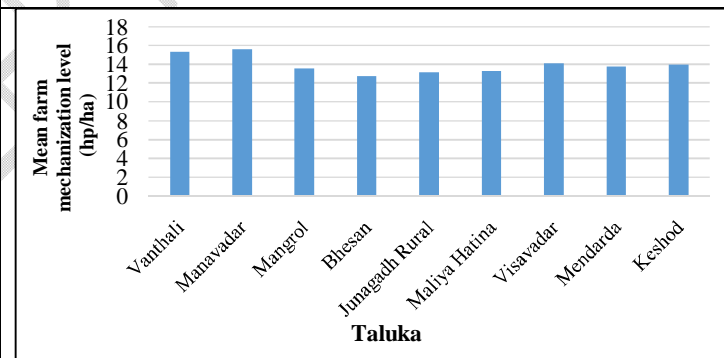


Fig. 10 Farm mechanization level of 450 farmers in Junagadh district

CONCLUSION

The finding concluded that 57 % of respondents belonged to middle age group, 27 % of the respondents were educated up to medium school level, 72 % of respondents had a medium size of family, 40 % of the respondents had medium sized land holdings, 36 % of the respondents had well source of irrigation, 79 % of the respondents had electric pump and 31 % of the respondents had tractor. Majority of respondents used tractor drawn for seed bed preparation cultivator (70 %), blade harrow 70 % and plunger 70 %. 46 % of respondents used tractor drawn auto-seed cum fertilizer drill (before monsoon) for sowing, 66 % of respondents used mini tractor drawn multipurpose implement for interculturing, 98 % of respondents used battery sprayer for plant protection, 67 % of respondents used tractor drawn blade harrow for harvesting, 99.56 % of respondents used electric or oil engine operated thresher for threshing in Junagadh district. Mean of mechanical energy for different operations such as seedbed preparations, sowing, interculturing, plant protection, harvesting and threshing was found to be 4419.5, 1543.20, 348.49, 131.98, 1072.33 and 658.62 MJ/ha respectively in Junagadh district. Survey represent that the mean farm power is 45.05 hp and farm mechanization level is 13.92 hp/ha in Junagadh district.

REFERENCES

1. Woodroof, J. G. (1983). Peanuts: production, processing, products (3rd ed.). West port, CN: The Avi Publishing Company, Inc.
2. Harisudan, C. and Subrahmaniyan, K. (2020). Evaluation of irrigation levels and plant geometry for drip irrigation in groundnut (*Arachis hypogaea* L.). *Journal of Oilseeds Research*, **37(4)**: 267-271.
3. Lakhani, A. L. and Vagadia, V. R. (2023). Development and performance evaluation of shelling unit of power operated groundnut decorticator. *Internaional Journal of Agricultural Sciences*, **19(1)**: 254-260.
4. Sinhar, A. A. and Gajjar, P. P. (2023). Modification in existing groundnut digger shaker for invert windrowing. *Internaional Journal of Agricultural Sciences*, **19(2)**: 599-604.
5. Anonymous (2023a). "Peanut Explorer". Available at, https://ipad.fas.usda.gov/cropeplorer/cropview/comm_chartview.aspx?fattributeid=1&cropid=2221000&startrow=1

[&sel_year=2022&ftypeid=47®ionid=sasia&cntryid=IND&nationalGraph=False.](#)

Accessed on 07thMarch, 2023.

6. Anonymous (2023b). "Area, Production and Yield". Available at, <https://dag.gujarat.gov.in/estimate-guj.htm>. Accessed on 10thMarch, 2023.
7. Anonymous (2021). Groundnut outlook, Agricultural Market Intelligence Centre, PJTSAU, pp: 1-2.
8. Lakhani, A. L., Patel, B. P. and Gajera, M. N. (2024). Unlocking the potential of zero-tillage farming: challenges, opportunities, and key influences on adoption. *Journal of Experimental Agriculture International*, 46(8): 1027-1036.
9. Zala, P. H.; Jadav, N. B. and Kapuriya, T. D. (2021). Exploring Suggestion from the Farmers Regarding Prevent Pests Damage in Groundnut (*Arachis Hypogaea*) Crop. *Indian Research Journal of Extension Education*, **21(2&3)**: 101-103.
10. Zala, S. K.; Panigrahy, S. R. and Gohel, P. R. (2023). Perception of farmers for groundnut seed in Porbandar district of Gujarat. *The Pharma Innovation Journal*, **12(6)**: 2471-2474.
11. Rathod, D. B.; Tayade, B. D. and Kharge, A. P. (2022). Profile and problems of farmers growing summer ground nut in Ahemadnagar district. *The Pharma Innovation Journal*, **11(12)**: 117-120.
12. Raval, A. H.; Chavda, M. G. and Vavalia, P. N. (2003). Constraints in adoption of agricultural engineering technology for groundnut cultivation. *Gujarat Journal of Extension Education*, **14**: 11-17.