Original Research Article

IDENTIFICATION OF CROPPING PATTERN AND DISPOSAL PATTERN OF SELECTED CROPS IN CHHOTAUDEPUR, PANCHMAHALS AND DAHOD DISTRICT OF GUJARAT

ABSTRACT

The present study was conducted to achieve four main objectives: identifying cropping patterns, determining disposal patterns of selected crops, analysing the gap between recommended and actual package of practices, and identifying challenges faced by farmers in production and marketing. Data were collected from 150 farmers using a descriptive research design and purposive sampling, with a focus on chilli cultivation in Chhotaudepur and okra in Halol, and potato cultivation in Dahod. The study examined cropping patterns in Chhotaudepur, Halol, and Dahod regions, considering climate, soil, and market factors. Cultivation included crops such as paddy, maize, chilli, okra, wheat, cotton, tomatoes, potato, turmeric, and groundnut. While farmers generally followed recommended sowing time and sowing method for chilli, okra, and potato, deviations in seed treatment, seed rate, and spacing affected yields. Chilli and okra were mainly sold to local agents, while potato sales involved agents, contractors, APMCs, and FPOs. Challenges included high input costs, diseases, transportation issues, and storage limitations. Proposed solutions encompass quality seeds, improved storage, disease-resistant varieties, cost reduction measures, enhanced credit access, and knowledge sharing initiatives.

Keywords: *Cropping pattern, Package of practices, Disposal pattern, Chilli and Okra*

1. INTRODUCTION

India's agricultural sector performed well, growing at 3.6% in 2020-21 and 3.9% in 2021-22 (FAO,2022). In the 2020-21 crop year, the country achieved a record food grain production of 315.7 million tonnes. The horticulture sector saw substantial growth, with the production of fruits, vegetables and other crops reaching 326.6 million tonnes (MoA&FW 2020-2021). Around 4% of the world's gross domestic product (GDP) comes from agriculture (world bank, 2022). Between the years 2000 and 2020, the agricultural value added increased significantly by 78%, reaching a value of $3.6 USD. This means that the overall contribution of agriculture to the economy grew substantially during this period (FAO, 2022). After China, India produces the second-most fruits and vegetables worldwide. India produced 204.61 million tonnes of vegetables and 107.10 million tonnes of fruits in 2020–21, fruits were grown on 6.66 million hectares of land while vegetables were grown on 10.35 million hectares (NHB,2021).The total geographical area of Gujarat is 196 lakh hectares. Out of this, around 101 lakh hectares are used for cultivation, which makes up 51% of the total geographical area. The state has a total gross cropped area of about 128 lakh hectares. Out of the cultivable land, around 56.14 lakh hectares are irrigated, accounting for 55% of the net cultivable area (RKVY, 2022).

India, Nigeria, Mali, Sudan, and Pakistan are top five countries for okra production. India leads in area, production, and productivity, contributing 59.74% to global production. Nigeria has a smaller share, while Mali stands out with high productivity. Sudan and Pakistan have smaller areas and productions. China, India, Ukraine, USA, and Russia are top five countries for potato production. India, Bangladesh, Thailand, China, and Ethiopia are top five countries for chilli production (FAOSTAT, 2021).

Cropping patterns change from macro to micro-regions in both space and time and are mainly determined by physical, cultural and technological variables (Rahman, 2020). The adoption gap in vegetable production practices was highest in the use of recommended doses of FYM (49.17%), sowing time during the summer season (50.84%), seed rate (71.66%), use of varieties (79.16%), plant protection measures for insects/pests (51.67%) and diseases management (54.16%). Approximately half of the vegetable growers (49.16%) had a medium-level adoption gap in implementing recommended vegetable production practices (Tekale et al., 2022). India is negatively impacted by low agricultural yield, inadequate irrigation facilities and inadequate infrastructure including cold storages, marketplaces, highways and transportation. Additionally, significant post-harvest losses and handling inefficiencies contribute to low productivity and high production costs (Shankar et al., 2017). Prices are the main determining factor for choosing any crop for cultivation. Any fluctuation in the price will impact area allocation under the crop. Kumar et al., 2022 conducted a study and revealed that the influence of Agra market price extended to other markets, notably affecting potato prices and establishing it as a prominent factor in the interconnection between different selling places.

Under this background the present study aimed to achieve four objectives: identify the cropping pattern, understand disposal pattern of selected crops, analyse the gap between recommended and actual package of practices, and identify problems faced by farmers in production and marketing of selected crops.

2. METHODS

The research study used a descriptive research design to provide a detailed description of the topic. A non-probability sampling method, and purposive sampling technique, were utilised. The sampling unit consists of farmers, while the sampling size includes a total of 150 farmers, with 60 from Chhotaudepur, 45 from Halol, and 45 from Dahod. The study focuses on a selected region encompassing Chhotaudepur for chilli, Halol for okra, and Dahod for Potato respectively. For primary data collection used a semi-structured schedule and secondary data were collected from different Private and Government publications, review papers, Literature and journals.

Analytical Tools:

Tabular Analysis:

For study cropping pattern, package of practices and disposal patterns tabular analysis were used.

Garrett's Ranking Technique:

- Garrett's ranking method was found by the Henry Garret and Woodworth (1969).
- Garrett's ranking technique was used for analysis of Problems faced by farmers and ranking given by respondents for each attribute were analysed.
- Thus, ranks assigned by the individual respondents were converted into percent position values by using the formula.
- Percent position= 100(Rij-0.5)/Nj

Where, Rij stands for rank given for ith factor by the jth individual

Nj stands for number of factors ranked by jth individual

3. RESULTS AND DISCUSSION

Cropping Pattern of Chhotaudepur, Halol and Dahod

Table 1. Cropping pattern of Chhotaudepur

Sr. no.	Cropping pattern			Frequency (n)	Percentage (%)
	***Kharif* season**	***Rabi* season**	**Summer season**		
1	Paddy	Maize	Green Gram	18	30
2	Maize	Maize	Cowpea	2	3.3
3	Paddy	Wheat	Okra	5	8.3
4	Paddy	Maize	-	5	8.3
5	Paddy	Chilli	-	7	11.8
6	Pigeon pea	-	Black Gram	5	8.3
7	Tomato	-	-	3	5
8	Cotton	-	-	15	25
			Total	**60**	**100.0**

The analysis of Table 1 showed that in Chhotaudepur, during the *Kharif* season, paddy cultivation was prevalent among farmers to mitigate waterlogging situation caused by heavy rainfall. The majority (30%) followed the cropping pattern of Paddy-Maize-Green Gram. Overall, paddy and maize were the main crops grown in the region. Other observed cropping patterns included Maize-Maize-Cowpea (3.3%), Paddy-Chilli (11.8%), and Paddy-Wheat-Okra (8.3%). Chhotaudepur farmers also grew essential vegetables like chilli and okra. Additionally, a few farmers cultivated tomatoes (5%) and cotton (25%) during the *Kharif* season.

Table 2. Cropping pattern of Halol

Sr. no.	Cropping pattern			Frequency (n)	Percentage (%)
	***Kharif* season**	***Rabi* season**	**Summer season**		
1	Paddy	Wheat	-	16	35.6
2	Maize	Maize	-	6	13.3
3	Paddy	Okra	-	5	11.1
4	Paddy	Potato	-	6	13.3
5	-	Chilli	-	2	4.5
6	Groundnut	Wheat	-	8	17.7
7	Cotton	-	-	2	4.5
			Total	**45**	**100.0**

The analysis of Table 2, showed that in the Halol region, farmers predominantly cultivated paddy during the *Kharif* season. Maize was also grown during both *Kharif* and *Rabi* seasons. Paddy and maize were the primary crops cultivated by the majority of farmers across a significant portion of the land. A notable percentage of farmers (35.6%) followed the Paddy-Wheat cropping pattern, while a smaller proportion (11.1%) practiced the Paddy-Okra pattern. Chilli in *Rabi* and cotton in *Kharif* were grown by a few farmers (4.5% each) in the *Kharif* season. Other cropping patterns involving different

crops in *Kharif* and *Rabi* seasons, such as Groundnut-Wheat and Paddy-Potato, were also observed. These patterns likely resulted from various factors like climate, soil type, and market demand.

Table 3. Cropping pattern of Dahod

Sr. no.	Cropping pattern			Frequency (n)	Percentage (%)
	***Kharif* season**	***Rabi* season**	**Summer season**		
1	Paddy	Wheat	-	3	6.7
2	Maize	Maize	-	9	20.0
3	Turmeric	Maize	-	7	15.6
4	Paddy	Potato	-	8	17.8
5	Maize	-	Green gram	4	8.9
6	Groundnut	-	-	5	11
7	Cotton	-	-	9	20
			Total	**45**	**100.0**

The analysis of Table 3 showed that in the Dahod region, the majority of farmers cultivated paddy. Additionally, (20%) farmers followed the Maize-Maize cropping pattern, cultivating maize in both the *Kharif* and *Rabi* seasons. Paddy and maize were the primary crops grown by farmers in Dahod, with widespread cultivation across the region. Farmers also adopted various cropping patterns, such as Paddy-Wheat (6.7%), Paddy-Potato (17.8%), and Turmeric-Maize (15.6%). A small number of farmers (11% and 20%) focused on groundnut and cotton cultivation, respectively, during the *Kharif* season. These cropping patterns were influenced by factors like market demand and suitability to the region's climate and soil conditions.

Disposal Pattern

Table 4. Disposal pattern of chilli at Chhotaudepur

No.	Particular	Frequency (n)	Percentage (%)	Quantity (tonnes)	Percentage (%)
1	Pre-harvest contract	15	25	58	24.9
2	Local agent	35	58.3	143	61.3
3	APMC	10	16.7	32	13.8
	Total	**60**	**100**	**233**	**100**

In Chhotaudepur, the majority of chilli farmers (58.3%) sold their produce to local agents, while (16.7%) preferred the Agricultural Produce Market Committee (APMC). Approximately (25.0%) entered into pre-harvest contracts with some organizations.

Table 5. Disposal pattern of okra at Halol

No.	Particular	Frequency (n)	Percentage (%)	Quantity (tonnes)	Percentage (%)

1	Pre-harvest contract	8	17.8	22	19.1
2	Local agent	32	71.1	68	59.2
3	APMC	5	11.1	25	21.7
	Total	**45**	**100**	**115**	**100**

In Halol, the primary selling channel for okra farmers was local agents, accounting for (71.1%) of the farmers. Additionally, a considerable portion of farmers (17.8%) opted for pre-harvest contracts. However, the utilization of the Agricultural Produce Market Committee (APMC) for selling okra in this region was limited, accounting for (11.1%) of the farmers. Farmers' choices of selling channels were influenced by factors such as the convenience of the channel, its accessibility, and their personal preferences.

Table 6. Disposal pattern of Potato at Dahod

No.	**Particular**	**Frequency (n)**	**Percentage (%)**	**Quantity (tonnes)**	**Percentage (%)**
1	Pre-harvest contract	18	40	230	47.8
2	Local agent	17	37.8	191	39.7
3	APMC	6	13.3	28	5.7
4	FPO	4	8.9	33	6.8
	Total	**45**	**100**	**480**	**100**

In Dahod some tribal areas lacking proper transportation infrastructure, (37.8%) of farmers sold their produce to local agents come from other villages or districts. Pre-harvest contracts were popular, with (40%) of farmers selling through this way. Only (13.3%) sold to Agricultural Produce Market Committees (APMCs), likely due to tribal dominance and small land sizes. Additionally, (8.9%) sold through Farmer Producer Organizations (FPOs) for benefits like cheaper inputs and new markets.

Package of Practices

Table 7. Chilli package of practices at Chhotaudepur

No.	Practices	Recommendation	No. of farmers follow recommendation	Farmers followed practices	No. of farmers don't follow recommendation
1	FYM	10 tonnes/ha	2	5-7 tonnes/ha	58
2	Sowing time	Dec-Jan	60	Dec-Jan	0
3	Sowing Method	Transplanting	60	Transplanting	0
4	Seed rate	200-250 gm/ha	3	160-180 gm/ha	57
5	Seed treatment	Hot Water	0	-	60
6	Spacing	75*60 cm	28	75*65 cm	32
7	Irrigation interval	1 week	60	1 week	0
8	Method of irrigation	Drip/Flood	60	Flood	0
9	Yield	15-20 tonnes/ha	12	13-14 tonnes/ha	48

Based on Table 7 in chilli recommended dose of FYM is 10 tonnes per hectare, but only 2 farmers followed this recommendation, while the majority used 5-7 tonnes per hectare. For sowing time, all 60 farmers followed the recommendation of sowing in December-January. Similarly, all 60 farmers used the recommended transplanting method for sowing. Only 3 farmers followed the recommended seed rate of 200-250 grams per hectare, while the rest used 160-180 grams per hectare. None of the farmers used hot water treatment for seed treatment. Regarding spacing, 28 farmers followed the recommendation of 75*60 cm, while the others used 75*65 cm. All farmers followed the recommended irrigation interval of 1 week, and all 60 farmers used flood irrigation instead of drip irrigation. Finally, only 12 farmers achieved the recommended yield of 15-20 tonnes per hectare, while the majority obtained 13-14 tonnes per hectare.

Table 8. Okra package of practices at Halol

No.	Practices	Recommendation	No. of farmers follow recommendation	Farmers followed practices	No. of farmers don't follow recommendation
1	FYM	10-12 tonnes/ha	7	6-9 tonnes/ha	38
2	Sowing time	Jan-Feb	45	Jan-Feb	0
3	Sowing Method	Drilling	45	Drilling	0
4	Seed rate	8-10 kg/ha	13	5-12 kg/ha	32
5	Seed treatment	Soak the seeds 24 hrs	0	-	45
6	Spacing	45*30 cm	19	40*30 cm	26
7	Irrigation interval	8-10 Days	23	7-9 days	22
8	Method of irrigation	Drip/Flood	45	Flood	0
9	Yield	10-12 tonnes/ha	2	8-10 tonnes/ha	43

Based on Table 8 in okra recommended dose of FYM is 10-12 tonnes per hectare, but only 7 farmers followed this recommendation, while the majority used 6-9 tonnes per hectare. For sowing time, all 45 farmers followed the recommendation of sowing in January-February. Similarly, all 45 farmers used the recommended drilling method for sowing. Only 13 farmers followed the recommended seed rate of 8-10 kg per hectare, while the rest used 5-12 kg per hectare. None of the farmers soaked the seeds for 24 hours for seed treatment. Regarding spacing, 19 farmers followed the recommendation of 45*30 cm, while the others used 40*30 cm. 23 farmers followed the recommended irrigation interval of 8-10 days, and all 45 farmers used flood irrigation instead of drip irrigation. Finally, only 2 farmers achieved the recommended yield of 10-12 tonnes per hectare, while the majority obtained 8-10 tonnes per hectare.

Table 9. Potato package of practices at Dahod

No.	Practices	Recommendation	No. of farmers follow recommendation	Farmers followed practices	No. of farmers don't follow recommendation
1	FYM	25 tonnes/ha	2	13-21 tonne/ha	43
2	Sowing time	The second fortnight of Nov	45	The second fortnight of Nov	0
3	Sowing Method	Potato Planter	45	Potato Planter	0
4	Seed rate	3 tonnes/ha	22	3-4.5 tonnes/ha	23
5	Seed treatment	Mancozeb+ Sankhjiru	5	Mancozeb	40
6	Spacing	45*15 cm	17	40*10 cm	28
7	Irrigation interval	1 week	12	10-15 days	33
8	Method of irrigation	Drip / Flood	45	Flood	0
9	Yield	30-35 tonnes/ha	27	23-37 tonnes/ha	18

Based on Table 9 in potato recommended dose of FYM 25 tonnes per hectare, but only 2 farmers followed this recommendation, while the majority used 13-21 tonnes per hectare. For sowing time, all 45 farmers followed the recommendation of sowing in the second fortnight of November. Similarly, all 45 farmers used the recommended Potato Planter method for sowing. 22 farmers followed the recommended seed rate of 3 tonnes per hectare, while the rest used 3-4.5 tonnes per hectare. Only 5 farmers used the recommended seed treatment of Mancozeb+ Sankhjiru, while the majority used only Mancozeb. Regarding spacing, 17 farmers followed the recommendation of 45*15 cm, while the others used 40*10 cm. 12 farmers followed the recommended irrigation interval of 1 week, and all 45 farmers used flood irrigation instead of drip irrigation. Finally, 27 farmers achieved the recommended yield of 30-35 tonnes per hectare, while the majority obtained 23-37 tonnes per hectare.

Problems Faced by Farmers

Table 10. Garrett's Ranking table for chilli problems at Chhotaudepur

Factor	Mean Score	Rank
High input price	72.6	1
Diseases	64.3	2
Natural factors	57.8	3
Insects	56.7	4
Lack of transportation	51.4	5
Poor knowledge	48.6	6
Lack of seed availability	44.7	7
Weeds	36.6	8
Lack of credit facilities	36.0	9
Lack of storage	29.3	10

From the above Table 10 high input prices were ranked as the most significant factor, with a mean score of 72.6. Diseases were ranked second, with a mean score of 64.3, followed by natural factors (57.8) and insects (56.7). Lack of transportation (51.4) and poor knowledge (48.6) were also identified as key challenges. Factors such as lack of seed availability (44.7), weeds (36.6), lack of credit facilities (36.0), and lack of storage (29.3) were ranked lower in terms of their impact on farming activities.

Table 11. Garrett's Ranking table for Okra problems at Halol

Factor	Mean Score	Rank
Diseases	72.5	1
Lack of seed availability	64.7	2
Natural factors	59.0	3
Lack of transportation	56.8	4
High input price	51.8	5
Insects	48.1	6
Poor knowledge	44.1	7
Lack of storage	36.2	8
Weeds	35.8	9
Lack of credit facilities	29.0	10

From the above Table 11 Diseases were ranked as the most significant factor affecting farming, with a mean score of 72.5. Lack of seed availability followed closely in second place, with a mean score of 64.7. Natural factors ranked third at 59.0, while lack of transportation ranked fourth at 56.8. High input prices were identified as the fifth-ranking factor at 51.8. Insects, poor knowledge, lack of storage, weeds, and lack of credit facilities were also recognized as contributing challenges, with decreasing mean scores.

Table 12. Garrett's Ranking table for Potato problems at Dahod

Factor	Mean Score	Rank
Lack of seed availability	64.6	1
Lack of storage	58.6	2
Diseases	56.1	3
High input price	54.7	4
Lack of transportation	53.9	5
Lack of credit facilities	52.7	6
Natural factors	49.6	7
Insects	40.9	8
Poor knowledge	35.0	9
Weeds	31.8	10

From the above Table 12 the lack of seed availability was ranked as the most significant factor affecting potato crop, with a mean score of 64.6. Lack of storage followed closely in second place, with a mean score of 58.6. Diseases ranked third at 56.1, while high input prices were identified as the fourth-ranking factor at 54.7. Lack of transportation and lack of credit facilities were ranked fifth and sixth, respectively. Natural factors, insects, poor knowledge, and weeds were recognized as contributing challenges, with decreasing mean scores.

4. CONCLUSION

The study showed that farmers in the Chhotaudepur, Halol and Dahod regions adjusted their crop choices according to climate, soil conditions and market demands. In Chhotaudepur, crops such as paddy, maize, chilli, okra, wheat, cotton and tomatoes were cultivated. Halol predominantly focused on paddy, maize, okra, chilli and cotton. Meanwhile, in Dahod, farmers grew paddy, maize, wheat, potato, turmeric, groundnut and cotton. Farmers followed the recommended sowing time and sowing method for chilli, okra and potato cultivation. Nevertheless, they deviated from the recommended practices in seed treatment, seed rate and spacing, which resulted in slightly reduced yields and variations in crop production. These variations were attributed to their modifications in these specific aspects of cultivation.

Farmers primarily sold chilli and okra to local agents, while potato was mostly sold to local agents and pre-harvest contractors, with a small portion going through APMCs and FPOs. The farmers chose these selling methods based on their convenience and the prevailing market conditions. The challenges included high input prices, diseases, transportation issues and storage limitations. Challenges may be resolved by improved storage, disease-resistant varieties, reduced cost of input and knowledge-sharing initiatives. These solutions were aimed at helping farmers overcome the

difficulties they encountered, enabling them to enhance productivity, reduce losses and improve their overall agricultural practices.

5. REFERENCES

Food and Agriculture Organization of the United Nations. (2021, Feb 17). Retrieved from: https://www.fao.org/faostat/en/#home

Garrett EH, Woodworth RS. Statistics in psychology and education. Vakils, Feffer and Simons Pvt. Ltd., Bombay. 1969;329.

Kumar R, Mishra S, Gautam Y, & Kalia A, & Panigrahy, SR. Indian Potato Markets Linkage and Impulse Response of Price Shocks. Agricultural Mechanization in Asia, Africa & Latin America.2022;53(07):9485-9491.

Ministry of Agriculture and Farmers Welfare. (2021, Feb 16). Retrieved from National Horticulture Board: https://www.google.com/search?client=firefox-b-d&q=NHB%2C2021

National Horticulture Board. (2022, May 5). Retrieved from General Info: https://www.nhb.gov.in/PDFViwer.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxDaDNwRDpz4q6R0Hh+hnPuWq+W12MeIQdkF1VzrubGVPyTbpj25i9n7Prjq8sf2SQL0bQiMhwNstOAx+l1UvQ8I=

RahmanN. Crops pattern change and agricultural diversification: A case study of Domar Upazila, Nilphamari. International Journal of Agricultural Science and Food Technology. 2020;6(1):22-29.

RKVY. (2022, May 5). Retrieved from Publication: https://rkvy.nic.in/

ShankarT, SinghK, &DwiwediS. An Analysis on Problems of Vegetables Marketing in Farmers' Market of Bihar-A Case Study in Samastipur District. *Economic Affairs*. 2017;62(1):175-183.

TekaleV, BhagatM, & TaydeV. Adoption gap in vegetable production practices. *The Pharma Innovation Journal*. 2022;11(2):2891-2894.

World Bank. (2022, May 5). Retrieved from Project. https://www.worldbank.org/en/home