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A STUDY ON MARKET POTENTIAL, FARMERS' BUYING BEHAVIOUR, AND SATISFACTION LEVEL TOWARDS WATER SOLUBLE FERTILIZERS IN ANAND AND NARMADA DISTRICTS OF GUJARAT

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ABSTRACT

This study was conducted between February 2016 and May 2016 on a sample of 200 farmers selected on convenience from 20 villages of four talukas of Anand and Narmada districts of Gujarat. Primary data were collected by survey method on pretested semi-structured schedules, and appropriate tools were used to analyze data. The findings suggested that about 90 per cent farmers in Narmada district used Water Soluble Fertilizers (WSFs). More than 80 per cent farmers used Calcium Nitrate and NPK (19:19:19) grade of WSFs. The annual market potential of water soluble fertilizers in Anand and Narmada districts came out to the tune of Rs 14 crore and Rs. 50 crore, respectively. In Anand, GSFC was leading company and in Narmada, Nagarjuna was leading in the sales of WSFs. Most farmers were using WSFs for more than seven years. Around 31 per cent farmers in Anand and 59 per cent farmers in Narmada District used drip irrigation method on their farms. On the other hand, 52 per cent farmers in Anand and 18 per cent farmers in Narmada did foliar application of WSFs. About 55 per cent farmers preferred to purchase WSFs from local retail shop. At the time of purchase past experience highly affected the farmers. Satisfaction level towards using WSFs was high among farmers as they found that WSFs application gives high yield, and small quantities of these fertilizers are sufficient, making it economic for the farmers.

KEYWORDS: Water Soluble Fertilizers, Gujarat, Market Potential, Farmer's Buying Behaviour, Satisfaction Level

INTRODUCTION

Fertilizers have played a vital role in the success of India's green revolution and consequent self-reliance in food-grain production. The increase in fertilizer consumption has contributed significantly to sustainable production of foodgrains in the country. During the last decade, the advances in technology have resulted in revolutionary changes in the development of more efficient fertilizers. Water-soluble fertilizer is a multi-compound fertilizer that can be dissolved in water, its absorption and utilization is relatively high as compared to conventional chemical fertilizers. The fixed amount of nutrient available to the plants can be easily provided by the help of this fertilizer. The technology of this fertilizer is best suited for modern irrigation system. Fertigation-grade water soluble fertilizers are found highly effective in banana even in places where quality of irrigation water is not fully suitable for the drip system (IIHR, 2012). The use of Water Soluble Fertilizers also prevents ground water contamination. These above technological advancements differentiate water soluble fertilizers from the conventional chemical fertilizers. The usage of water-soluble fertilizer application is simple. As it is

well suited in advanced irrigation technology, it not only saves water and fertilizer, but also saves labor cost. Chaurasiua S *et al* (2005), in their study entitled *"Effect Of Foliar Application Of Water Soluble Fertilizers On Growth, Yield, And Quality Of Tomato"* found that Application of 5 foliar sprays of water soluble fertilizers significantly increased the plant height, number of branches, Number of fruits, average fruit weight, fruit length, fruit diameter, TSS, yield and the net profit of tomatoes.

An increase in the adoption rate of technologically developed fertilizers throughout the globe has supplemented the sales value of the water-soluble fertilizers in the recent past. According to TechSci Research (2014) report **"India Water Soluble Fertilizers Market Forecast & Opportunities, 2019"**, the market for water soluble fertilizers in India stood at 110,000 MT, in volume terms, in the year 2013 and is projected to witness strong growth over the next five years. The global water-soluble fertilizers market, in terms of value, is projected to reach USD 15.30 Billion in 2020, at a CAGR of 5.6 per cent from 2015 to 2020 (Markets and Markets, 2015). Nitrogen, phosphate and potassium are key product segments of the water soluble fertilizers market. On the basis of fertilizer type, the market for water soluble fertilizers in India is segregated into 19-19-19, 0-52-34, 13-0-45, 12-61-0, 13-40-13 and 0-0-50 segments. The 0-52-34 segment is expected to post fastest growth during next five years. Water-soluble NPK fertilizers are being used for different crops like vegetables and ornaments. It enhances the nutrient uptake and reduces the leaching loss of nutrients in soluble form (Deepa, 2005). The country's Western region, comprising Maharashtra and Gujarat, holds largest share in terms of WSF consumption as soil in this region contains high clay level, which makes it difficult for cultivation.

The major drivers of the market are its wider applications of green house, government subsidies for adoption of this technology, economic incentives with Fertigation to reduce ground water consumption and rising demand for micro-irrigation systems. The major constraints for this market are higher costs as compared to other soil fertilizers and also its negative seasonal impact and requirement of high initial setup cost. Wide scope of micro irrigation system in Asia creates opportunities for the acceptance of water soluble fertilizers. The market is largely organized with the presence of various established players such as Deepak Fertilizers, Nagarjuna Fertilizers and Coromandel International. Several other players such as Aries Agro, IFFCO and Gujarat State Fertilizers and Chemicals are also seeking to establish their footprint in the market and capitalize on growth opportunities available in the country.

In this context, this study was conducted in Middle Gujarat to find the market potential, farmers' buying behaviour and satisfaction level towards WSFs. The study was undertaken with the objectives of (i) to estimate the market potential of Water Soluble Fertilizers, (ii) to study the buying behaviour of farmers for Water Soluble Fertilizers, and (iii) to determine the farmers' satisfaction level of Water Soluble Fertilizers.

DATA AND METHODOLOGY

The Study was conducted in Anand and Narmada districts of Gujarat between February 2016- May 2016. Primary data were collected with the help of semi-structured schedules from the respondent farmers. The secondary data were collected from various publications, District Panchayat Office, Department of Agriculture & Cooperation**,** the official Website of the Government of Gujarat, International fertilizer Industry Association, and the Fertilizer Association of India (FAI).

The study was descriptive in nature where non-probability method of sampling was applied. Under the applied

sampling method, the convenient sampling was done to select a sample of 200 farmers; 10 from each of the selected villages (20 villages) of four talukas of Anand and Narmada districts. Descriptive statistics was used to achieve the stipulated objectives of the study. Other tools that were used are given below

Market Potential of WSFs= Total area covered under MIS+ Estimated area under foliar spray * Doses Required (Kg/acre) of WSF * Price of the product per Kg

Garrett Ranking Method

To find out the most significant factor which influenced the purchase of WSFs by the farmers, Garrett's ranking technique was used. As per this method, the farmers were asked to assign the rank for all factors and the outcome of such ranking was converted into score value with the help of the following formula:

Percent position = 100 (Rij – 0.5)/ Nj

Where Rij = Rank given for the ith variable by jth respondents

Nj = Number of variable ranked by jth respondents

With the help of Garrett's Table, the percent position estimated was converted into scores. Then for each factor, the scores of each individual were added and then total value of scores and mean values of score was calculated. The factors having highest mean value was considered to be the most important factor.

The farmer's satisfaction towards Water Soluble Fertilizers was measured through Likert Scale.

The area of the study was confined Anand and Narmada Districts of Gujarat. The study is based on a sample and therefore the results cannot be generalized. The analysis was purely based on the responses of the farmers, and therefore a bias may exist. There is a scope to expand the study to a large sample. More districts may be covered to find region wise market potential of WSFs in Gujarat

RESULTS AND DISCUSSIONS

General Characteristics

In Anand and Narmada districts, majority of farmers were small (land holding < 2 hectare), followed by semi-medium (2-4 hectare). Majority of the surveyed farmers (51 per cent in Anand and 37 per cent in Narmada) belonged to 31-41 age groups, followed by 41-50 age groups (26 per cent in Anand and 24per cent in Narmada). More than 50 per cent farmers in both districts attained S.S.C/ H.S.C level of education. Farmers had different sources of irrigation. Most of the farmers (82 per cent in Anand and 76 per cent in Narmada) had borewell facility. Majority of farmers in both districts had income between 1-3 Lakh. In Anand, vegetables were sown more than other crops; 44 per cent farmers in Anand grew three crops a year. In Narmada, banana was the major crop; 52 per cent farmers grew only one crop in a year. Out of 100 farmers surveyed in Narmada District, 20 per cent farmers grew 2 crops and 12 per cent farmers grew 3 crops during the period of study.

Of the selected farmers in Anand district, 92 per cent used Urea, 87 per cent used DAP, 82 per cent used MAP, and 61 per cent used SSP. Potash is sufficient in soil of Anand District, so no farmer used MOP. In Narmada District out of 100 respondent farmers, 92 per cent farmers used Urea, 91 per cent used DAP, 89 per cent used MOP, and 85 per cent

farmers used MAP on their farms.

Awareness and Use of Water Soluble Fertilizer

Out of surveyed farmers, 95 per cent were aware of WSFs in Anand and 98 per cent were aware of WSFs in Narmada District. Around 91 per cent of these (i.e. who were aware) used WSFs in Anand district while 90 per cent of aware farmers used WSFs in Narmada district. High price of the fertilizer was the major reason behind less number of farmers using it in Anand district. In Narmada, the farmers who were aware of WSFs but did not used them, cited the absence of micro irrigation on their farm, which prevents them to use WSFs.

Grade Wise Use of Water Soluble Fertilizers by the Sample Farmers

Water Soluble Fertilizers are classified based on the presence of Nitrogen percentage. In the market, 7 different Grades of WSFs are available. Farmers used WSFs based on nitrogen requirement for their crops. In both the districts covered under this study, more than 80 per cent farmers used 19:19:19 and Calcium Nitrate. Calcium Nitrate grade is considered useful for growth and strength of the plants. Around nine per cent farmers in Anand and five per cent farmers in Narmada district used NPK 13:40:13 Grade. Sulphate of Potash (00:00:50) was not used by farmers in Anand District as Anand soils are sufficient in Potash. Around 62 per cent of farmers used SOP in Narmada District, as it improves colour, flavor and storing quality of fruits and vegetables.

Companies Preferred by Farmers for Water Soluble Fertilizer

Major companies engaged in sale of Water soluble Fertilizers in study area included GSFC (Gujarat State Fertilizer & Chemicals Limited), GNFC (Gujarat Narmada Valley Fertilizers & Chemicals Limited), Aries, IFFCO, Nagarjuna, Vanita Agro and others (Safal, Shubhlabh, Hifa, Tata, Agricon, Mahafed, Deepak Fertilizers and Chemicals, Richfield, Orvin)

Monoammonium Phosphate (12:61:00) has been used for strong roots and shoot growth of fruits and vegetable in the study area. Out of 64 farmers in Anand district (who use this WSF), 13 per cent farmers preferred to use “Sardar” brand of GSFC, followed by Coromandal (12per cent), and other companies’ brand in Anand District. In Narmada District, out of 71 Farmers who use this grade of WSF, 14 per cent farmers buy Nagarjuna brand and 12 per cent farmers preferred to purchase brand of Aries Agro Pvt. Ltd Company.

Nine farmers used **NPK (13:40:13)** grade in Anand, while only five farmers used it in Narmada district. Vanita Agro, Safal, Coromandal, Shubhlabh, Richfield, Orvin (Topsol) were the major companies selling WSF grade NPK (13:40:13) in Anand and Narmada district. Out of 9 farmers in Anand, 33 per cent farmers preferred to purchase from Coromandal and 22 per cent purchased from Orvin. In Narmada District, Vanita Agro product was preferred by 40 per cent farmers and remaining 60 per cent farmers bought from Safal, Coromandal and Orvin.

To purchase WSF **Sulphate of Potash (00:00:50) grade,** the study revealed that out of 64 farmers in Narmada District, 25 per cent farmers preferred Nagarjuna Company’s product, followed by around 17 per cent farmers who preferred to purchase from Aries Agro Pvt. Ltd. There were 14 per cent farmers who preferred to purchase from Coromandal. None of the farmers used 00:00:50 Grade in Anand District due to high potash content in the soil of the district.

Around15-16 companies were engaged in selling **NPK (19:19:19) grade** of WSF in the selected districts during the survey period. Around 87 per cent of farmers used this grade of WSF in Anand and Narmada District. The survey revealed that around 14 per cent farmers of these preferred to purchase NPK (19:19:19) WSF grade from Aries Agro Pvt. Ltd, followed by 13 per cent who preferred Coromandal, and 11 per cent who preferred GSFC's product. In Narmada District, Nagarjuna is leading company (selling to 16 per cent farmers) followed by Coromandal (selling to 15 per cent farmers) and GSFC (selling to 13 per cent farmers).

To purchase water soluble fertilizer grade **Mono- Potassium Phosphate (00:52:34),** the survey revealed that out of 40 farmers in Anand District, 22 per cent farmers preferred to use GSFC Company's product followed by 17 per cent, and 10 per cent farmers who preferred to use Coromandal and Subhlabh Company's product, respectively. In Narmada District, 77 farmers used this Grade of WSFs. Of those, 16 per cent farmers used Nagarjuna Company's Grade, followed by Aries and Coromandal Company's Grade, each preferred by 14 per cent farmers. In Anand District Safal and Orvin Company's Grade of (00:52:34) not used by any Farmer but in Narmada District 3 per cent farmers bought this grade from Safal and four per cent bought from Orvin.

The company's preferred by farmers for **WSF Potassium Nitrate (13:00:45 grade)** in Anand were GSFC (preferred by 15 per cent farmers), followed by Nagarjuna (13 per cent), Aries (11 per cent) and Coromandal (11 per cent). In Narmada district 13 per cent farmers preferred Nagarjna, followed by Aries (12 per cent) and GSFC (11 per cent).

Around 83 farmers used **Calcium Nitrate** in Anand district. Of these, 12 per cent farmers preferred Coromandal Company's product followed by Aries, Nagarjuna and Shubhlabh (9.5 per cent each). In Narmada District 15 per cent farmers used Nagarjuna Company's Grade, followed by 14 per cent farmers who used Aries grade. About 13 per cent of farmers used Coromandal Grade.

Out of 91 farmers in Anand District, 34 per cent farmers had been using WSFs for more than 7 years, 30 per cent farmers had been using for 6-7 years, 24 per cent farmers had been using WSFs for 4-5 years. In Narmada District out of 90 farmers, 38.6 per cent farmers had been using WSFs for more than years, 27 per cent farmers had been using for 6-7 years, and, 21 per cent farmers had been using WSFs for 4-5 years. Around 10 per cent farmers in both districts have started using WSF 2-3 years ago.

Mode of Application of Water Soluble Fertilizers

In Anand District out of 91 farmers, 52 per cent farmers applied WSFs by foliar spray which is mostly preferred on vegetables crops, 32 per cent farmers applied WSFs through Drip Irrigation facility, and only 16 per cent farmers used both Drip Irrigation and Foliar Spray for WSF application. In Narmada District, out of 90 farmers, 59 per cent farmers applied WSFs by Drip Irrigation, 23 per cent farmers used both Drip Irrigation and foliar Spray, and only 18 per cent farmers used Foliar Spray.

Information Source Regarding Water Soluble Fertilizers

In both Districts, most of the information regarding WSFs disseminates through friends /relatives, farmers meeting, krishi mahotsava, and fertilizer dealers. In Narmada District, 24 per cent farmers received information through farmers' meet which was conducted by Jain Drip Irrigation Systems and Netafim Drip Irrigation System.

Sources of Purchase of Water Soluble Fertilizers

In both Districts, most of the farmers (51 per cent in Anand and in 53 per cent in Narmada) purchased WSFs from local private Retailer or Dealers situated in their respective village or nearby city. In Anand, 19 per cent farmers and in Narmada 21 per cent farmers purchased directly from company depot and Retail shop. Around 10 per cent farmers purchased from any Agro services center in Anand, a few farmers also purchased Direct From Company depot and Local cooperative society like IFFCO.

Factors Affecting Purchase of Water Soluble Fertilizers by Farmers

Farmers buying behaviour change all time and the sample farmers chose product based on various factors which are listed in Table 1, for Anand district and Table 2 for Narmada district. Past experience was the highest ranked factor. Farmers also used particular product based on quality which is highlighted by Nutrient composition on bags. Quality was ranked second important factor behind purchase of WSFs. Brand Image was also another factor. Brand image, secured third rank, credit was ranked fourth on the basis that 1 month or 2 month credit may be given by any shopkeeper to the farmers. Price of WSFs fertilizers are not also same for every grade; company wise there could be a minor change in price. Pricing was ranked fifth. Last factor to affect the farmer's purchase of WSFs was easy availability of WSFs in any retail shop or at any other purchase place. The factor was ranked by 34 per cent farmers.

In Narmada district, past experience was the highest ranked factor, followed by brand image, quality, easy availability, credit and price.

Farmers' Satisfaction Level towards Use of Water Soluble Fertilizers

According to the data on use of WSFs fertilizer, five parameters were considered to analyze the farmers' satisfaction level towards the use of WSFs. These were: increase in crop yield, time saving, cost saving, labour saving, and lesser quantity requirement as compared to the conventional fertilizers.

Table 3 and Table 4 present Farmers' satisfaction level towards use of Water Soluble Fertilizers in Anand and Narmada district, respectively. Analysis of the data collected from the survey in Anand district reveals that the sample farmers reflected their highest satisfaction level when they found an increase in crop yield post the use of WSFs. Less requirement of quantity of water soluble fertilizers was another reason that added to farmers' satisfaction. Majority of farmers were dissatisfied with the price of product; as the price of WSFs were higher than conventional fertilizers.

In Narmada district, farmers' satisfaction level towards the use of Water Soluble Fertilizers was reflected maximum through high yield of crop, followed by lesser requirement of quantity of WSFs, time saves, and labour saving. Farmers in Narmada district, too feel that WSFs are prices high and are not relatively cost saving in nature

Market Potential of WSFs in Narmada and Anand Districts

Market potential of different grades of WSFs was calculated for the estimated area under foliar spray and Micro Irrigation Systems in two districts. Table 5 and Table 6 present the estimated market potential of Water Soluble Fertlizers in Anand and Narmada district, respectively. In Anand (Table 5), the sample area under foliar spray was 39 hectare, which was around 15 per cent of the total sample area (269 hectare). It should be noted that foliar spray of WSFs is generally done in vegetable crops which cover around 36914 hectare of cultivated land in Anand. We considered 15 per cent

(5537.10 ha or 13676.64 Acre) of the vegetable area as the potential area for foliar spray. As per the Gujarat Green Revolution Company, the area under MIS in Anand district (for the period of study) was 9487.27 acre. The market potential of WSFs varied between Rs 0.18 crore to Rs 2.73 under two application methods) for different grades. In general, the survey area was dominated by banana & few other fruits and vegetables. Depending upon the no of crops, and expansion in area under MIS, the potential may increase in near future. However, the combined market potential of WSFs in Anand District was around Rs 14 crore, taking in to account the current area under MIS and foliar spray

In Narmada district (Table 6), the sample area under foliar spray was 27 hectare, which was around 14 per cent of the total sample area (196 hectare). The total area under vegetables in Narmada district was 1546 hectare. We considered 14 per cent (216.44 ha or 534.6 Acre) of the vegetable area as the potential area for foliar spray. As per the Gujarat Green Revolution Company, the area under MIS in Narmada district (for the period of study) was 50509.03 acre. The market potential of WSFs varied between Rs 0.007 crore to Rs 14.55 crore for different grades of WSFs in Narmada district for two methods of application (foliar and MIS). Depending upon the number of crops, and the expansion in area under MIS, the potential may increase. However, the combined market potential of WSFs in Narmada district was around 50 crore, taking in to account the current area under MIS and foliar spray.

CONCLUSIONS

The market of Water Soluble Fertilizers is growing and the application of these fertilizers is precise which helps in raising crop yields. However, their high price as compared to conventional fertilizers may hamper their use. At affordable rates, Water Soluble Fertilizers may be helpful in increasing area under Micro Irrigation; another way leading to agricultural sustainability in long run. The promotional activities should be undertaken by the companies which are engaged in the marketing of water soluble fertilizers in selected districts.

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APPENDICES

List of Tables

Table 1: Factors Affecting Buying of Water Soluble Fertilizers in Anand District

Factors Affecting Buying of WSF's by Farmers	Garrett Score	Rank
Past experience	67.27	1
Quality	62.01	2
Brand Image	52.52	3
Credit	51.89	4
Price	45.49	5
Easily available	34.05	6
Source: Authors' analysis of data from primary survey		

Table 2: Factors Affecting Buying of Water Soluble Fertilizers in Narmada District

Factors Affecting Buying of WSF's by Farmers	Garrett Score	Rank
Past experience	67.04	1
Brand Image	62.32	2
Quality	52.23	3
Easily available	48.41	4
Credit	46.67	5
Price	40.30	6
Source: Authors' analysis of data from primary survey		

Table 3: Farmers' Satisfaction Level of Using WSFS in Anand District

Parameters	Highly Disagree	Disagree	Neutral	Agree	Highly Agree	Weighted Mean	Rank
High yield	0	0	2	24	65	4.69	1
Low quantity	4	8	10	20	49	4.12	2
Time saving	0	8	15	33	35	4.04	3
Labour saving	2	30	12	20	27	3.43	4
Cost saving	44	22	23	2	0	1.81	5
Source: Authors' analysis of data from primary survey							

Table 4: Farmers' Satisfaction Level of Using WSFS in Narmada District

Parameters	Highly Disagree	Disagree	Neutral	Agree	Highly Agree	Weighted Mean	Rank
High yield	0	0	0	23	67	4.74	1
Time saving	0	2	12	33	43	4.3	2
Labour saving	2	10	15	25	38	3.96	3
Low quantity	0	15	19	24	32	3.81	4
Cost saving	44	22	23	1	0	1.78	5
Source: Authors' analysis of data from primary survey							

Table 5: Market Potential of WSFS in Anand District

Grade Name	Total Area Under Mis (Acre)	Estimated Area Under Foliar Spray (Acre)	Dosage / Acre (Kg)		Price (Rs/Kg)	Value (In Rs Crore)		In Volume (In Ton)	
			MIS	Foliar		MIS	Foliar	MIS	Foliar
19-19-19	9487.27	13676.64	10	4	85	0.81	0.47	94.87	54.71
12-61-00	9487.27	13676.64	32	12	90	2.73	1.48	303.59	164.12
00-52-34	9487.27	13676.64	21	8	115	2.29	1.26	199.23	109.41
13-00-45	9487.27	13676.64	30	12	80	2.28	1.31	284.62	164.12
Calcium Nitrate	9487.27	13676.64	10	3	45	0.43	0.18	94.87	41.03
Total						**9**	**4.70**	**977.19**	**533.39**
Total Market Potential						**13.70**		**1510.58**	
Source: Authors' analysis through survey information (Primary and Secondary data)									

Table 6: Market Potential of WSFS in Narmada District

Grade Name	Total Area Covered Under Mis Land (Acre)	Estimated Area Under Foliar Spray (Acre)	Dosage/Acre (Kg)		1 Kg Price (Rs)	Value in Rs Crore		In Volume (in Ton)	
			MIS	Foliar		MIS	Foliar	MIS	Foliar
19-19-19	50509.03	534.6	10	4	85	4.29	0.018	505.09	2.14
12-61-00	50509.03	534.6	32	12	90	14.55	0.058	1616.29	6.42
00-52-34	50509.03	534.6	15	8	115	8.71	0.049	757.64	4.23
13-00-45	50509.03	534.6	30	12	80	12.12	0.051	1515.27	6.42
00-00-50	50509.03	534.6	20	5	77	7.78	0.021	1010.18	2.67
Calcium Nitrate	50509.03	534.6	10	3	45	2.27	0.007	505.09	1.69
Total						**49.73**	**0.204**	**5909.56**	**23.57**
Total Market Potential						**49.93**		**5933.09**	
Source: Authors' analysis through survey information (Primary and Secondary data)									