

Analytical Study To Measure Satisfaction Level Of Farmers For Water Soluble Fertilizers For RCF In District Pune.

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Abstract: *This study concentrates on the economic problem confronting agriculture in India. It focuses on Pune district in India to analyse and measure satisfaction level of farmers for water soluble fertilizers. Indian economy is largely dependent on agricultural income even today. This study attempts to explain stagnation of traditional agriculture and test hypothesis empirically. The data collected for this study is from primary source using well structured questionnaire. Analysis is done using statistical tools to measure satisfaction level of farmers based on their land holdings. This research study has been conducted for RCF as the company being a market leader wanted to gather material inputs to invest in farmers for profitable economic growth.*

Key words: *fertilizers, water soluble fertilizers, agriculture.*

Introduction on RCF LTD.

Rashtriya Chemicals & Fertilizers Ltd. (RCF) is a Public Sector Undertaking (PSU) in India under the Ministry of Chemicals and Fertilizers of the Government of India, based in Mumbai. RCF is one of the leading producers of fertilizers in India.

Rashtriya Chemicals and Fertilizers Limited (a Government of India undertaking), was established in 1978 consequent to the reorganisation of Fertilizer Corporation of India. RCF manufactures Urea and Complex fertilizers (NPK) along with a wide range of Industrial Chemicals. It is 4th largest Urea manufacturer in India after IFFCO, NFL and KRIBHCO.

The Government of India holds 80% of the share capital of the company as on 31 March 2013.

1. **Trombay Unit**, Multiproduct integrated fertilizers & process chemicals factory in Mumbai spread across 765 acres (including township) ISO 14001, ISO-50001, OHSAS-18001 & ISO-9001 accredited, Manufactures Ammonia, Urea, Suphala, ANP, Methanol, Nitric Acid, Sulphuric Acid, etc.
2. **Thal Unit**, Large producer of Urea along with Industrial Chemicals located 100km south of Mumbai spread across 997 acres (including township) ISO 14001, OHSAS-18001 & ISO-9001 accredited Manufactures Ammonia, Urea, Methylamines, Formic Acid etc.

Introduction on Water Soluble Fertilizers

The application of water soluble fertilizer ensures healthy and abundant plants because it encourages rapid growth and root formation. Water soluble fertilizers are formulas that are dissolved in water and applied to plants at the base or foliage throughout the growing seasons. With commercialization of Agriculture there were bound to be certain consequences and the adverse effects of indiscriminate usage of irrigation water and fertilizers has led to the once fertile soils becoming saline and waterlogged. To overcome this issue, micro irrigation systems (fertigation) for dispensing water soluble formulation of nutrients is increasingly being adopted in place of conventional methods of irrigation. Such water soluble formulations are known as Water Soluble Fertilizers and these can be dissolved in water and added or leached out of the soil

easily. Micro irrigation systems include drip irrigation equipment, micro sprinklers and sprays among others.

With the help of WSFs it is far more easier to control the precise amount of nutrients available to plants, thereby greatly reducing the risk of oversupply and undersupply of nutrients. This results in reduced costs due to optimum usage of fertilizers as well as lower labour cost on account of reduced energy and manpower requirement for irrigation. Moreover, these fertilisers also have a higher absorption rate as compared to traditional fertilisers and have substantially reduced levels of residue that may cause contamination.

The major factors for demand for such products include popularity of micro irrigation systems, government support in the form of subsidies for promoting eco-friendly fertilization, increasing number of greenhouses and the efficiency and effectiveness of Water Soluble Fertilizers.

Water Soluble Fertilisers are available in double and multi-nutrient combinations and with or without secondary nutrients or micronutrients. They contain macronutrients – Nitrogen (N), Phosphorus (P), and Potash (K). Some of the Micronutrients such as Magnesium, Calcium, Sulphur, Copper, and Molybdenum are also present in water soluble fertilizer in various compositions. Due to the specific composition, Water soluble fertilizers allow the farmers to choose, with a great amount of precision, the amount of each nutrient that they wish to add to their crops.

Apart from fertigation, these products are also being applied via foliar spray. WSFs also known as Specialty Fertilisers are predominantly being used in horticultural crops such as vegetables, fruits and flowers, and plantation crops are fast emerging as an important crop segment.

The use of Speciality Fertilizers is essential for adequate and balanced fertilization.

Types of Water Soluble Fertilizers

FOLIAR APPLICATION

Foliar fertilizers are applied directly to leaves. The method is almost invariably used to apply water-soluble straight nitrogen fertilizers and used especially for high value crops such as fruits.

DRIP IRRIGATION

Rashtriya Chemicals & Fertilizers Ltd, manufactures 100% water soluble fertilizers containing all the three major plant nutrient i.e. Nitrogen, Phosphorus and Potash for crops grown in green houses as well as other field crops. Sujala is available in two forms Foilar grade and drip grade.

- 1) Foliar, suitable for spraying and
- 2) Drip grade which is suitable for application through drip irrigation system.

Use of Sujala either through drip or foliar prevents deterioration of soil texture as soil complexion and mechanical damage to the crops is eliminated.

The major features of Sujala foliar and drip grades are as follows.

SUJALA 19:19:19 DRIP

- Sujala reaches directly at the root zone along with required water through drip.
- As Sujala is salt free, the drip system does not get clogged thus enhancing life of the micro irrigation system.

- Sujala has a long life and can be stored and used as and when required.
- Proportion of air, moisture and nutrients through Sujala are effectively maintained at the root zone resulting into quality and bumper yield.

Features:

- Total Nitrogen 100% soluble in water.
- Amide Nitrogen 10.5%
- Amonical Nitrogen 4.5%
- Nitrate Nitrogen 4.0%
- Total Phosphorus 100% soluble in water.
- Total Potassium 100% soluble in water.
- Free from harmful Sodium and Chlorine.
- Nutrients are totally absorbed due to salt free features.

SUJALA 19:19:19 FOLIAR (100% water soluble foliar fertilizer)

Sujala is the best foliar fertilizer for crops like paddy, wheat, pulses, and vegetables for green house cultivation, nurseries, kitchen gardens and for all types of field crops. Use of Sujala results in cost saving and at the same time significantly increases the yield.

Features:

Sujala contains 100% water soluble N, P and K in 19:19:19 ratio and it is free from salts like sodium and chlorides and neutral in nature.

Hence, it is 100% soluble even in hard water and gets fully and immediately absorbed by plants. Sujala contains major plant nutrients like Nitrogen, Phosphorous and Potash along with secondary Nutrients like Sulphur and Magnesium. All crops need Sulfur, which is normally deficient in the soil. Hence, Sujala supplements the Sulfur requirement of the plants. Use of Sujala results in saving of fertilizer cost by 30 to 40% and also increases yield by 20 to 40% depending upon the type of crop, Sujala can be mixed with any pesticides. And thus labour cost of additional spray can be avoided. Sujala has a long shelf life and thus can be stored and used as and when required.

DIFFERENT TYPES AND GRADES OF 100% WATER SOLUBLE FERTILIZERS AND THEIR AGRONOMIC BENEFITS.

1) Potassium Nitrate (13-0-45)

- Omitted vide S.O. 540 (E) dt. 12. 05. 2003.
- Moisture per cent by weight, maximum. 0.5
- Total nitrogen (all in Nitrate form) per cent by weight, minimum. 13.0
- Water soluble potash (as K₂O) per cent by weight, minimum 45.0
- Sodium (as Na) (On dry basis) per cent by weight, maximum 1.0
- Total chloride (as Cl) (On dry basis) per cent by weight maximum 1.5
- Matter insoluble in water, per cent by weight, maximum 0.05

Agronomic Benefits:

- 13-0-45 has proved to be an ideal fertilizer for application as a regular K source.
- Because of its nitrate nitrogen content, this is the best source for nitrogen and potassium.
- Due to its rapid action and its nitrogen content 13-0-45 is the most suitable K source for foliar application.
- It is useful for increasing quality of crops, to get early maturity and ripening of crops.
- It increases diseases resistance of plants.

2) Mono- Potassium Phosphate (0-52-34) (100% water soluble)

- Moisture per cent by weight, maximum 0.5
- Water soluble phosphates (as P₂O₅) per cent by weight, minimum 52.0
- Water soluble potash (as K₂O) per cent by weight 34.0
- Sodium (as Na Cl) per cent by weight (on dry basis), maximum 0.025

Agronomic Benefits:

- 0-52-34 Mono Potassium Phosphate (MKP) is the perfect product to supply Phosphate along with Potash simultaneously to the crops.
- The crops which are in flowering stage to fruit development stage.
- 0-53-34 is the perfect grade to boost maximum flowering and better fruit development.

3) NPK 13:40:13 (100% water soluble)

- Total nitrogen per cent by weight, minimum 13.0
- Nitrate nitrogen per cent by weight, maximum 4.4
- Ammoniacal nitrogen per cent by weight, maximum 8.6
- Water soluble phosphates (as P₂O₅) per cent by weight minimum 40.0
- Water soluble potash as K₂O per cent by weight, minimum 13.0
- Sodium (as NaCl), per cent by weight on dry basis, maximum 0.15
- Matter insoluble in water per cent by weight 0.5

Agronomic Benefits:

- 13:40:13 is the perfect product to supply Phosphate along with Nitrogen and Potash simultaneously to the crops.
- The crop which is in flowering stage to fruit developing stage 13:40:13 is the perfect grade to boost maximum flowering and better fruit development, bud differentiation and early maturity of crops.

4) NPK 18:18:18 (100% water soluble)

- Total nitrogen per cent by weight, minimum 18.0
- Nitrate nitrogen per cent by weight, maximum 9.8
- Ammoniacal nitrogen per cent by weight, minimum 8.2
- Water soluble phosphate (as P₂O₅) per cent by weight, minimum 18.0
- Water soluble potash (as K₂O) per cent by weight, minimum 18.0

- Sodium as NaCl per cent by weight on dry basis 0.25
- Matter insoluble in water per cent by weight, maximum 0.5

Agronomic Benefits:

- 18:18:18 is supported with Magnesium so that the initial growth will be enhanced.
- The NPK is especially developed to meet with all the nutrient requirements of the crops, during the early vegetative stage after planting.

5) Calcium Nitrate

- Total nitrogen per cent by weight, minimum 15.5
- Ammoniacal nitrogen per cent by weight, maximum 1.1
- Nitrate nitrogen as N per cent by weight, minimum 14.4
- Water solubles calcium as per cent by weight, minimum 18.8
- Water insolubles per cent by weight, maximum 1.5

Agronomic Benefits:

- Calcium is necessary for cell wall development, cell enlargement and cell division.
- It increases shelf lives of fruits, prevents fruits and flower dropping, gives strength to the plants.
- Increases pulp content of fruits and over yield.

6) Sulphate of Potash-SOP (00:00:50)

- Water soluble Potash (as K₂O) 50%
- Water soluble Sulphur (as S) 17.50%
- 100% water soluble fertilizer containing Potassium, a major essential plant nutrient

Agronomic Benefits:

- It the only potassium fertilizer that also provides the crop with sulphur, an essential secondary macronutrient.
- Useful for giving better colour, sweetness and better keeping quality to the produce.

7) Mono Ammonium phosphate (MAP) 12:61:00

- Ammoniacal Nitrogen, per cent by weight, minimum 12.00
- Water soluble Phosphates (as P₂O₅), per cent by weight, minimum 61.00

Agronomic Benefits:

- Used mainly as a P- source.
- 12:61:00 (MAP) is the perfect product to supply Phosphate and Nitrogen simultaneously for soil grown crops.
- Nitrogen in MAP is present in the Ammonia form, offering better control over N- availability of plants.

8) 17:44:00

- Total Nitrogen by weight, per cent minimum 17
- Total nitrogen, per cent 17.00
- Water soluble phosphate 44%
- Moisture per cent 0.5%
- Matter insoluble 0.5%

Agronomic Benefits:

- Useful for uniform bumper and healthy flowering and root development
- Offers better control for n- availability having Ureic(NH₂)
- It is free from chloride, sodium and other harmful elements for plants.

Literature Review

Amaliyar K and Singh R. (2016) have observed in their study to estimate the market potential of water soluble fertilizers secondly to study the buying behaviour of farmers towards water soluble fertilizers and thirdly to determine the farmers satisfaction level of water soluble fertilizers . The findings of this study advocates that in Narmada the farmers were aware of water soluble fertilizers but did not use them because their lands cited with absence of micro irrigation, the research further states that 0:52:34 grade of water soluble fertilizers will be the fastest growing grade within 5 years which will be preferred the most by farmers. 0:0:50 grade i.e sulphate of potash 25 farmers of Narmada district out of 64 preferred this grade from Nagarjuna Company whereas 17 farmers preferred buying from Aries Agro Pvt Ltd. 87 farmers from Anand and Narmada use 19:19:19 grade. The past experience of farmers is the factor that affects the buying behaviour of farmers as seen in table 1 and 2. After the use of Water Soluble Fertilizers the farmers say they are highly satisfied with the increase in yield output as seen in table 3 and 4. This study concludes that the demand for water soluble fertilizers is growing and these fertilizers are précised for the increase in yields of crops however high prices hamper the use of fertilizers, micro irrigation is the leading to agricultural sustainability in the long run. The companies selling these fertilizers should be engaged in promoting them. The gap in this study shows that not only promotion but also suggestions from friend of farmers demonstration effect from the company is necessary. The pre and post results of using fertilizers also include limited parameters.

Sharma A. (2014) in his research study observed to ascertain the awareness of satisfaction of farmers with regard to availability of existing agricultural information services and programmes ,the study also wanted to find out what various channels and sources through which information is obtained to farmers following to assess the roles of agricultural professionals, existing public libraries and Community Information Centres (CICs) that provide agricultural information to the farmers. The conducted study reveals the findings of satisfaction through personal contact sources, satisfaction through group contact sources, satisfaction through mass contact sources, the data revealed elders, family members and neighbours/relatives/friends are the two most important sources through which farmers obtain information which reveals that farmers rely on information on their known persons, it also advocates that maximum farmers got below average satisfaction from public library/

CICs information, the study clearly shows T.V and radio are the two most important mass communication sources of getting information through group contact. The study concludes that farmers rely on their own persons for information and farmers are aware of the new advanced technology so the agriculture development should be put on fast track. The study also concludes that farmers have below average satisfaction from Gramsevaks, Block panchayat officers, University specialist, Minikits, meetings, field days and agricultural tours. These sources should be more approachable to the farmers so that information can be more easily available to the, similarly radio and tv are cheap, popular and common resource means in the rural area where information can be spread widely this will also help in improving current technology and improve economic status of farmers and country. The gap in this study shows that the research is only focused on opinions of farmers on sources of communication mentioned above.

Objective of the Research

The primary objective of this research is to study the satisfaction level of farmers after using fertilizers in district Pune.

A research which was conducted in Indapur taluka which falls in district Pune, this research showed the results of pre usage and post usage of water soluble fertilizers where the research was tested on 7 different parameters. They include effect on health on crops before and after using water soluble fertilizers, effect on soil before and after using water soluble fertilizers, effect on total yield output before and after using water soluble fertilizers, workforce before and after using water soluble fertilizers, margins before and after using water soluble fertilizers, consumption of water before and after using water soluble fertilizers and satisfaction of farmers before and after using water soluble fertilizers.

Research Methodology

Research methodology

Research methodology is a method to solve the research problem systematically. It involves gathering data, use of statistical techniques, interpretations, and drawing conclusions about the research data. It is a blueprint, which is followed to complete the study.

Nature of research

This research study is a descriptive research. A descriptive research needs a specification of questions lie who, what, why, where, when, and the way of the research conducted. Descriptive research systematically describes a situation, system, phenomenon, a service or a program and also provides information. Descriptive research does not exactly define the quantitative and qualitative research but it can utilize the elements of both with the same study. It also depends on the research questions, research design and data analysis that will be taken into consideration for the allotted topic of research. Descriptive research is all about explaining, describing and validating the findings, these are the main functions of descriptive research. It helps to organize the findings in order to fit them into explanations.

The study also focuses on quantitative research which has numerical representation for the purpose of describing and explaining that observations reflect. Quantitative research also

considers explanation by collecting the numerical data that are analysed using mathematically based methods particularly in statistics.

Research design

A research design refers to specific blueprint, outline, plan or strategy that will be utilized in order to accurately answer the research in the particular study. Research design involves numerous decisions regarding the topic to be studied among that particular population of interest with a certain set of research methods. Therefore the content will have in detail the specific design employed, area of population interested and the methods of which the data has been analysed. The study deals with the satisfaction level of famers and dealers towards water soluble fertilizers; it was conducted in District Pune, Indapur taluka of which 22 villages were covered. The total population is size of Indapur taluka is 18500. Two well-structured questionnaires were framed for the study one for the farmers and the other one for the dealers. The study covered 317 farmers and 15 dealers. The data was collected by random sampling method i.e. personally visiting the farmers and dealers in the Indapur taluka in Pune District. The questionnaire included independent and dependent variables which were not manipulated. The questions were on nominal type of scale. The questions were Likert scale questions, open ended question, and questions in which alternatives were available. It took about 1 min 30 sec to fill the questionnaire which was of four pages respectively. In this case the study deals with how water soluble fertilizers has an impact on crops, whether they are preferred by farmers or do they have alternative. The Cronbach's alpha value was .74 in case of the farmers' questionnaire. The data analysis was done using the SPSS tool by using statistical tool paired sample T-test. The sample size was calculated using the sample size calculator at 95% confidence level. The cronbach's alpha for the paired sample T-test is .700. This research study has a limitation which is Pune district. The farmers were been interviewed by me 3 months before doing the report and later they purchased water soluble fertilizers and used them on crops which has led to certain results.

Reliability Statistics

Cronbach's Alpha	N of Items
.700	14

Research hypotheses

H0- There is no significant effect on the health of crops before using water soluble fertilizers.

There is no significant effect on the health of crops after using water soluble fertilizers.

H0- There is no significant effect on soil before using water soluble fertilizers.

There is no significant effect on soil after using water soluble fertilizers.

H0- There is no significant effect on total yield output before using water soluble fertilizers.

There is no significant effect on total yield output after using water soluble fertilizers

H0- There is no significant effect on workforce before using water soluble fertilizers.

There is no significant effect on workforce after using water soluble fertilizers.

H0- There is no significant effect on margins before using water soluble fertilizers.

There is no significant effect on margins after using water soluble fertilizers.

H0- There is no significant effect on consumption of water before using water soluble fertilizers.

There is no significant effect on consumption of water after using water soluble fertilizers.

H0- There is no significant on satisfaction before using water soluble fertilizers.

There is no significant on satisfaction after using water soluble fertilizers.

Analysis

Paired Samples Test		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Effect of health on crops before using WSFs - Effect of health on crops after using WSFs	-.763	.433	.024	-.811	-.716	-31.388	316	.000
Pair 2	Effect on soil before using WSFs - Effect on soil after using WSFs	-.372	.568	.032	-.435	-.309	-11.661	316	.000
Pair 3	Total yield output before using WSFs - Total yield output after using WSFs	-.776	.487	.027	-.830	-.722	-28.342	316	.000
Pair 4	Workforce before using WSFs - Workforce after using WSFs	-1.101	.480	.027	-1.154	-1.048	-40.847	316	.000
Pair 5	Margins before using WSFs - Margins after using WSFs	-.744	.458	.026	-.795	-.694	-28.937	316	.000
Pair 6	Consumption of water before using WSFs - Consumption of water after using WSFs	-1.290	.501	.028	-1.346	-1.235	-45.857	316	.000
Pair 7	Satisfaction before using WSFs - Satisfaction after using WSFs	-.748	.503	.028	-.803	-.692	-26.487	316	.000

As seen in the Paired Samples T-test table

Pair 1 Effect of health on crops before using Water Soluble Fertilizers M= 1.22 whereas effect on health on crops after using Water Soluble Fertilizers M= 1.99 with sig(2.tailed) .000, which shows that there is a significant increase on the health of crops after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can clearly see that the mean difference is -.763 which shows a positive impact of water soluble fertilizers on crops, t value = -31.388 df=316

Pair 2 Effect on soil before using WSFs M= 1.40 whereas effect on soil after using WSFs M=1.77 with sig(2.tailed).000, which shows that there is a significant increase on the effect on soil after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean difference is -.372 which shows a positive effect on soil after using WSFs. t value = - 11.661 df = 316.

Pair 3 Total yield output before using WSFs M= 1.39 whereas total yield output after using WSFs M= 2.17 with sig(2.tailed).000, which shows there is a significant increase on the total yield output after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean difference is -.776 which shows a positive impact on the yield of crop output after using WSFs. t value -28.324 df=316.

Pair 4 Workforce before using WSFs M=1.45 whereas workforce after using WSFs M= 2.17 with sig (2.tailed).000, which shows there is a significant increase on the workforce after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean difference is - 1.101 which has a positive impact on workforce after the use of WSFs. t value -40.847 df=316.

Pair 5 Margins before using WSFs M=1.28 whereas margins after using WSFs M= 2.03 with sig(2. tailed).000, which shows there is a significant increase on the margins after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean difference is -.744 which has a positive impact on margins after the use of WSFs. t value -28.934 df=316.

Pair 6 Consumption of water before using WSFs M= 1.50 whereas consumption of water after using WSFs M= 2.79, which shows there is a significant increase on the consumption of water after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean difference is - 1.290 which has a positive impact on consumption after the use of WSFs. t value -45.857 df=316.

Pair 7 Satisfaction level of farmers before using WSFs M= 1.42 whereas satisfaction level of farmers after using WSFs M= 2.17, which shows there is a significant increase in the satisfaction level of farmers after using Water Soluble Fertilizers. The sig value is .000 which is less than .05 so we reject the null hypotheses and accept the alternate hypotheses. We can see that the mean

difference is -.748 which has a positive impact on satisfaction level of farmers after the use of WSFs .t value -26.487 df=316.

Findings & Conclusion

This finding proves that there is a positive impact after the use of water soluble fertilizers according to the paired sample t- test analysis therefore the research concludes that there is a significant increase on the health of crops after using water soluble fertilizers because this fertilizer acts as a starter and is very necessary for the maturity of the crop, the damage done on the soil was low as compared to other fertilizers because these fertilizers have low chemicals compared to other fertilizers and reacts good on soil, after using water soluble fertilizers there was an increase in the total yield output, the workforce required after using water soluble fertilizers is less as compared to before using water soluble fertilizers because water soluble fertilizers are mainly used through drip irrigation and it is automated whereas other fertilizers have to be used manually hence it requires more workforce. Farmers have found out that by using water soluble fertilizers there is an increase in yield and an increase in yield has led to an increase in profit margins. There is an increase in consumption of water soluble fertilizers because water soluble fertilizers consume more water than any other fertilizers. Hence the satisfaction level of farmers has increased after using water soluble fertilizers which has also given a major on the other parameters mentioned above.

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