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Research Article

Impact of NPK Fertilizers on Soil and Livelihood of Farmers in Sindh Province of Pakistan

Shahla Salahuddin*

Department of Agriculture, Karachi Institute of Engineering and Technology, Karachi, Pakistan

ABSTRACT

It is world-over known that NPK fertilizers are playing crucial role in increasing soil fertility and consequently farmers' livelihood. But some farmers are of opinions that soil quality has been deteriorated, so, resultantly, farmers' livelihood is also negatively affected due to continuous use of fertilizers. Such preliminary results raise two major questions globally as many researchers from the markets are also considering the NPK fertilizers are beneficial for both soils and farmers. Therefore, it is considered as one of the major factors in stimulating the market off-take. Direct Marketing tools can be effective for controlling the cost and risk factor in terms of installation of credit-transfer mechanism programs and discount offers on quantity purchased by dealers.

Keywords: Agriculture; Fertilizer; Farmers; Yield; Production; Food security; NPK; Correlation; Regression; Soil; Nutrition; Price; Market reform

INTRODUCTION

The establishment of a potential fertilizer industry by enhancing the policy in order to support fertilizer marketing becomes more competitive to lead the farmers for increasing agriculture productivity as per the demand. demand of fertilizer can be increased by strengthening farmers to generate more income through their product at farm level, in this regard policy makers need to promote capacity building program to enhance their knowledge and skills about the fertilizer use, improve the agriculture research program by investing on concerned institutions, facilitate them by providing the technologies which will support the farmers as well as industry and dealers to accomplish their goals efficiently. Therefore, heavy taxes and tariffs on inputs import is also one of the reasons that counts as disincentive matter from the regularity. It will discourage the industry to promote the smooth distribution of fertilizer and other inputs material in stable price range to maintain the agriculture development. since 1930 to early 1990 government were directly involved in fertilizer trading by rationing the foreign currency. while during 1980 till 1987 the demand of agriculture inputs material including fertilizer was increased amazingly, which is encouraged the regularity to promote the smallholder farmers by facilitating them with a loan program granted by Agricultural Finance Corporation. Policy shifting can improve the fertilizer industry become more efficient in distribution of fertilizer under the stable price range which will support the farmers to increase their agriculture productivity by using the appropriate nutrient contents for crop land fertility. In this order need to reform the agriculture policy to promote the farmers knowledge gaining program through capacity building, investment on agriculture research and development in the region by facilitating them with the latest technologies which will help to secure the soil fertility of the land accordingly and improve yield. Besides, the promotion from regularity will encourage fertilizer industry marketing system to be stabled, because the increasing factor in fertilizer price is heavy import duties on inputs material like heavy taxes and tariffs. On other hands, government loan program and subsidy on inputs by controlling the world markets transmission impacts, will promote the industry and domestic farmers to generate more profitability under the stable market price that will not only reduce the cost of production but also improve the agriculture productivity.

The higher price of nitrogen and other nutrients content around the world directly impact on domestic market which causes in declining the required consumption of plant in terms of growth that shows that farmers are not willing to purchase it by

Correspondence to: Shahla Salahuddin, Department of Agriculture, Karachi Institute of Engineering and Technology, Karachi, Pakistan, Tel: 922134543280; E-mail: shahlasykhan@gmail.com

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expending their cost of production, by this the crop yield also getting shrink. The higher prices not only declining the crop yield but also hitting the market mechanism in terms of demand and supply of fertilizer. The decreasing in fertilizer marketing price will favor to increase the consumption to maintain the soil fertility as well as to improve the crop yield. The study shows that the higher fertilizer prices also impact the crop yield and market supply in terms of low demand from the farmers. Farmers discouraging to increase their cost of production due to the instability of the commodity market prices. However, in domestic market the low fertilizer price would help to increase the crop yield along with the demand of fertilizer nutrients to be risen due to the increasing of consumption volume.

At the global scale the assessment shows that the rising trend of fertilizer price is impacted the crop production while the demand of agriculture foods are increased by 60% to 100% from its value in 2005 now on going it is expected to be rise due to the food insecurity around the world. The research community is considering improving the agriculture productivity by focusing the growing trend of world population and frequently changing demand of nutrients according to the land fertility to improve the soil condition for the long-term. However, the economic incentives will be the key factor to increase the growth of the agriculture productivity as the ever changing prices of fertilizer nutrients and land may impact the crop yield while it is discouraging the farmers to acquire the required amount of fertilizer for producing healthy crop to overcome the food insecurity in the region. In America the research from 1949 to 1964 shows that fertilizers are the best production factor as land substitute while in 1977 it has been illustrated that about 20% declined in fertilizer supplies due to high prices caused in declining the crop area approximately 21% by recording a reduction of 4% in crop production. The results shows that relative to higher fertilizer prices crop yields are affected significantly especially maize crop.

Furthermore, the data from the year 2001 to 2010 is indicating that fertilizer prices rapidly increased by 9% a year on an average by real terms. While it has taken peaks during the year 2008 to 2012 because of energy crisis and scarcity of phosphorous reserves which is impacted the market and it is an expectation that it will constantly increase in the future as wel. In 2015 Brunel lea proved by his study that land- fertilizer substitution will be stimulated due to the constant rising in fertilizer prices while the same trend has been observed in Sindh province of Pakistan. Crop areas are frequently shifted during the crop season without knowing the suitability of land for the crop in many crop areas. However, the food insecurity especially nutrients foods availability is rating on higher scale which causes to significantly boosting the malnutrition issues in women and children in the region. Rural households are unable to produce surplus agriculture foods by maintaining the nutrient value which is negatively impacted on their food consumption. While the skyrocketing price of fertilizer is also discouraging farmers to improve soil fertility and crop yield by expending their investment on crop sowing. Similarly it decreases the crop area.

Therefore, this study has been conducted to find out the realities for usage of NPK fertilizers on quality of soils and livelihood of farmers.

Following two important questions surveyed from 200 progressive farmers of Sindh Province, Pakistan

- If there is an alternative product like NPK available in the market which is favorable for soil and relatively cost effective, than why the application of DAP increased over the time?
- What is the impact of NPK application on farmers' wellbeing?

Limitations of the research study

- Domestic Fertilizer Dealers and Suppliers [Major Crop Producing Region-Pakistan]
- Farmers/Crop Producers [Major Crop Producing Region-Pakistan]

Significance of the study

- This study will help the fertilizer producing industries to increase the quality of fertilizers which must be famers friendly.
- This study will also be highly helpful to farmers for utilization of recommended quantity of fertilizers for better soil and livelihood

MATERIALS AND METHODS

For conducting this study, the literature review applied throughout the world has been followed. To analyze the prices of fertilizers, their utilization, impact on soil fertility and farmers' livelihood, the international standards have been maintained. For this analysis of variance has also been presented to acquire the effects of fertilizers on soils and farmers themselves significantly or non-significantly. For further accuracy, the nonparametric techniques have also been applied. In this connection, the response of farmers from different regions of the Sindh Province of Pakistan has been recorded to get the firsthand knowledge about the real condition of farming community. Moreover, during the study, a comprehensive survey has been conducted in which a well-skilled team of experts was involved to go through the ground realities as we could present the original picture of agriculture in this studied province. For measuring the monetary benefits of farmers "Net Benefit Ratio-NBR" was measured statistically. Meanwhile, a well-established work-plan has been framed to figure-out the agricultural productivity and profitability (Figure 1).

Figure 1: Illustration for work-plan was as under.

Idea of this study:

The idea of this study was taken from "Economic survey of Pakistan".

Adopted work-flow for getting realities (results):

The following work-flow was adopted to get the ground realties related with this study (Figure 2 and Table 1).

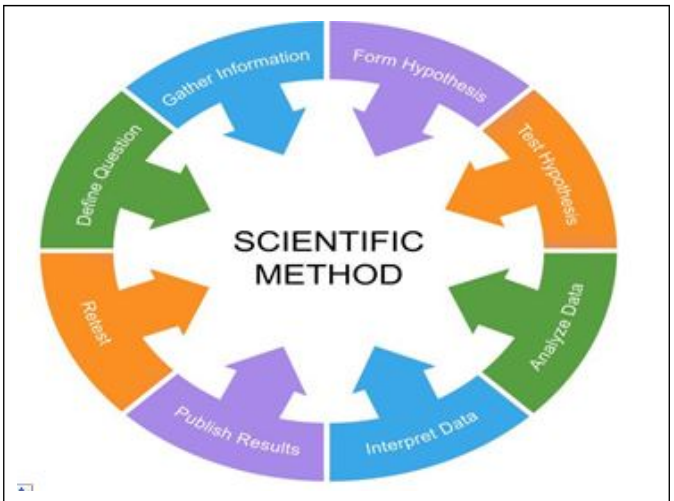

Figure 2: Adopted to get the ground realties related.

Table 1: District-wise distribution under study.

District	Province	Count of District
Badin	Sindh	37
Hyderabad	Sindh	31
Mirpurkhas	Sindh	35
N.Shehro Feroz	Sindh	32
Nawabshah	Sindh	35
Sanghar	Sindh	22
Sukkur	Sindh	28

Questions for this study:

It was a comprehensive large-scale study comprised of number questions, among these questions; the following main questions were framed for this study:

- If there is an alternative product like NPK available in the market which is favorable for soil and relatively cost effective, than why the application of DAP increased over the time?
- What is the impact of NPK application on farmers' wellbeing?
- What is difference in crop production during different years? For this last five years were taken as sample.
- If there is any effect of fertilizers on soil productivity?

The targeted farmers: The target audience of this research was smallholder farmers which is approximately accounted as 87% out of total farmers in region, according to economic survey of Pakistan agriculture section – approximately 12% farmers are progressive farmers by holding sizeable cultivable land to produce crop, remaining are smallholder farmers who is facing massive cost of cultivation due to rising price trend of inputs supply.

Measurement of variables: The following ways were adopted to measure the variables (Figure 3) (Tables 2 and 3).

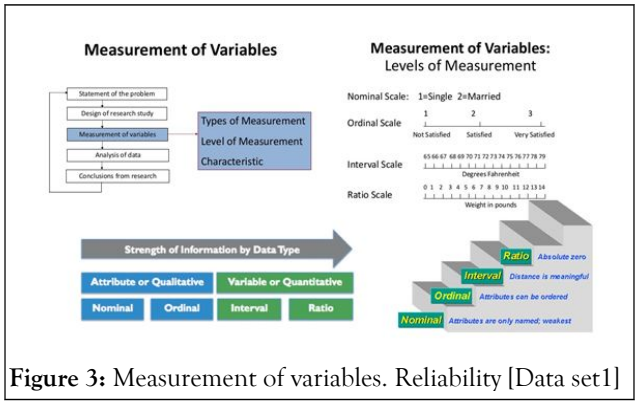

Figure 3: Measurement of variables. Reliability [Data set1]

Scale: All variables

Table 2: List wise deletion based on all variables in the procedure.

Case processing summary		N	%
Cases	Valid	13	100
	Excludeda	0	0
	Total	13	100

Table 3: Reliability statistics.

Cronbach's Alpha	N of Items
0.992	55

RESULTS AND DISCUSSION

Descriptive statistics for effects of fertilizers on farmers' livelihood and crop yield: In descriptive statistics Table 1 indicated the mean and standard deviation on the X variables impact on Y Variable. The mean is varying from 3.38–3.92; the highest mean was recorded for X1 which is indicating about the price impact on fertilizer consumption and yield. Tabulation shows the standard deviation of independent and dependent variables by calculating the 220 farmers' feedback against the questionnaire. This tabulation shows the projection sensitivity for dependent variable (Table 4).

Table 4: Descriptive Statistics.

	Mean	Std. Deviation	N
1. Farmers' livelihood [$Y_{1]}$	3.791	0.287	220
2. Crop yield [X_1]	3.831	0.279	220

Correlation among variables for effects of fertilizers on farmers' livelihood and crop yield: The next step involved to elaborate correlation of X variables and Y variables, for example independent and dependent variables correlation, by applying the analytical techniques and models to retrieve the correlation data of higher fertilizer price impact on sub variables. Also the descriptive command indicated a correlation statistical matrix in which at the top of the table the Pearson (correlation) showed the relation between the variables (Table 5).

Table 5: The Pearson (correlation) showed the relation between the variables.

		Agriculture development [Y_1]	Price impact yield [X_1]
Pearson correlation	1. Farmers' livelihood [Y_1]	1.001	0.472
	2. Crop yield [X_1]	0.472	1.001
Sig. tailed	1. Farmers' livelihood	1	1
	2.Crop Yield	0.001	1.001
N	1. Farmers livelihood [Y_1]	220	220
	2. Crop yield [X_1]	220	220

Analysis of Variance (ANOVA)–statistical model for effects of fertilizers on farmers' livelihood and crop yield: The Model Summary and ANOVA are in relation to predict the impact of independent variables of X on dependent variable. First the table ANOVA is giving the analytical analysis that the model is significant model. What it means that model to be significant, the prediction of significant model is related with the tolerance prediction of the analytical model. In other words, either the

rejection sensitivity predicts the depressive symptoms or not on outcomes variable. The significant of this model is (0.000b), this is less than the alpha (0.05), which is indicating that the model is significant. (e.g. if Sig. (p-value) is less than alpha (.05), we say the model is significant).

In this Model the equation would be:

F (5,214)=25.436, P=0.000

Meanwhile derived the adjusted R Square, in this model the adjusted R square is (.358) which is multiply with 100, the value shows that the percentage of Dependent Variable (DV) or outcome variable explained by the independent variable or predictor variable, in this model the 35.8% of the variance in depressive symptoms can be explained by one level of rejection sensitivity. Therefore, the adjusted R square have been derived by excluding it with 1-0.358 to get the outcome *i.e.* 0.642, means the tolerance statistics comparatively higher than the outcomes of adjusted R square value (Tables 6 and 7).

DV=0.358 x 100=35.8

Tolerance level=0.358-1=0.642

Table 6: Tolerance Level.

Model	Sig.	Statistics		
		Tolerance	Adjusted R Square	Tolerance Level
1. Farmers' livelihood	0.008			
2. Crop yield [X_1]	0	0.841	0.357	0.632

Table 7: Linear regression-residuals statistics.

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.48462	4.489243	3.890455	0.175081	220
Std. Predicted Value	-2.318	3.42	0	1	220
Standard Error of Predicted Value	0.016	0.23	0.034	0.017	220
Adjusted Predicted Value	-11.845	4.452002	3.816534	1.074646	220
Residual	-0.89845	0.646111	0.00E+00	0.227112	220
Std. Residual	-3.911	2.812	0	0.989	220
Stud. Residual	-3.957	2.893	0.003	1.006	220
Deleted Residual	-0.91996	16.14496	0.07392	1.113558	220
Stud. Deleted Residual	-4.101	2.945	0.003	1.014	220
Mahal. Distance	0.131	217.995	4.977	14.88	220
Cook's Distance	0	822.991	3.747	55.486	220
Centered Leverage Value	0.001	0.995	0.023	0.068	220
Dependent Variable: Agriculture Development [Y_1]					

CONCLUSION

The results of this study indicated that fertilizer has great impact on agricultural development, simply, farmers' livelihood and soil fertility. It was because of that as the fertilizer use increased the yield increased, which ultimately caused the general prosperity of the farming community of the area under study. In the light of this study, it is further recommended that fertilizers should be incorporated in agricultural soils for yield maximization from the crops to overcome the yield gap between population, its need and for poverty alleviation from the farmers.

REFERENCES

1. Megan Sheahan JA. Modeling the Effects of Input Market Reforms on Fertiliser Demand and Maize Production. J Agric Econ. 2016;67:420–447.
2. Minde IJ, Mazvimavi K, Murendo C, Ndlovu PV. "Supply and demand trends for fertilizer in Zimbabwe: 1930 to date": Key drivers and lessons learnt. AAAE 2010.
3. Brunelle T. Evaluating the impact of rising fertilizer prices on crop yields. Int Assoc Agr Eco. 2015;46(5):653–666.
4. Adekiya AO, Ejue WS, Olayanju A, Dunsin O, Aboyeji CM, Aremu C, et al. Different organic manure sources and NPK fertilizer on soil chemical properties, growth, yield and quality of okra. Sci Rep. 2020;10(1):1-9.
5. Agbede TM, Adekiya AO, Eifediyi EK. Impact of poultry manure and NPK fertilizer on soil physical properties and growth and yield of carrot. J Hortic Res. 2017;25(1).
6. Rafael RB, Fernández Marcos Ml, Cocco S, Ruello ML, Fornasier F, Corti G. Benefits of biochars and NPK fertilizers for soil quality and growth of cowpea (Vigna unguiculata L. Walp.) in an acid Arenosol. Pedosphere. 2019;29(3):311-333.
7. Šimon T, Czakó A. Influence of long-term application of organic and inorganic fertilizers on soil properties. Plant Soil Environ. 2014;60(7):314-319.
8. Ayeni LS, Adetunji MT. Integrated application of poultry manure and mineral fertilizer on soil chemical properties, nutrient uptake, yield and growth components of maize. Nature and science. 2010;8(1):60-67.