THE COMPARISON OF THE FARMERS' FERTILISER APPLICATION WITH THE SUGGESTIONS OF EXTENSION ORGANISATION IN THE INDETERMINATE TOMATOES FARMING (A Case Study of Tokat Province – TURKEY)

KIZILASLAN, N. AKCA, H.

Gaziosmanpasa University, Faculty of Agriculture, Department of Agricultural Economics, 60240, Tokat- TURKEY, e-mail: nurayk @ gop.edu.tr

Summary

In this study, whether farmers' fertiliser application is in harmony with fertiliser application suggested by Farmers Education and Extension Unit (FEEU) has been investigated. In addition, situation of contact of indeterminate tomatoes growers with extension staff has been examined. It has been determined that farmers have harmonised the suggestions of FEEU related to time of fertilisation and application of fertiliser but not harmonised related to amount of fertiliser to be used. According to Chi-square test, the relationship between educational level of farmers and the level of fertiliser use is not statistically significant. In addition, indeterminate tomatoes farmers have not had enough contact with extension staff. To use resources efficiently extension services should be directed to farmers more actively.

1. Introduction

Inputs such as fertiliser, pesticide, irrigation, and high yield varieties have an important role in the increase of yield per area in agricultural production. The increase of productivity in agriculture needs more input use but unconscious use of fertiliser without researching the nutrient needs of soil leads to environmental problems and loss of farmers' income. According to some scientists, quantity of fertiliser produced and consumed is an indicator of agricultural development (Anonymous, 1996).

Indeterminate tomatoes farming is new and important potential for farmers living in Tokat province of Turkey. In this study, farmers' fertiliser application and the suggestions of Extension agencies have been compared. The suggestions of extension units have been accepted as "the package of suitable growing technique" (Kaska *et al.*, 1992). This package prepared by research institutions in order to increase yield in agriculture is a method covering land cultivation, planting, seed, fertilisation, variety selection, and plant protection.

Agricultural extension is a transmission tool of knowledge and technology. Its another function is to create new behaviour in farmers and develop their willingness (Talug and Tatlıdil, 1993). Turkey has reached the level of self-sufficiency in many products and

also been a country exporting many agricultural products as a result of technology transfer to the rural areas. Farmers, extension staff, researchers, and trainers have played an important role in the reaching of Turkey to this level (Kumuk, 1996). There is an effect of knowledge on increasing of production in addition to the use of modern inputs (Ozkaya, 1996).

2. Material and Method

Data used in this study belong to the production period of 1998. There are 208 farmers growing indeterminate tomatoes intensively in the central county of Tokat province. 6 villages (25% of total villages) have been determined as a research area by the Method of Simple Random Sampling. The data have been collected from 52 farms determined at 95 % significant level and 10% error.

Chi-square has been used to test whether there is a relationship between farmers' fertiliser use and their educational level. In addition, Adjusted Yates was used (Düzgünes, 1975).

3. Results and Discussion

3.1. Comparison of Farmers' fertiliser application with suggestions of Farmer Education and Extension Unit

In research area indeterminate tomatoes growing area accounted for 17.11% of total farm land (table 1).

Table 1. Land Ownership Situation of Farms

Land size	Number of farm		Av. land	Share in	Land ownership situation (%)			
(da)	No	%	size (da)	Total (%)	land owner	tenant	sharecropper	total
1 - 5	16	30.77	3.38	7.29	66.67	18.52	14.81	100.00
6 - 10	19	36.54	7.79	12.70	68.24	25.00	6.76	100.00
11 - +	17	32.69	22.24	25.47	78.31	3.97	17.72	100.00
General	52	100.00	11.15	17.11	74.66	10.69	14.65	100.00

Average indeterminate tomatoes production area has been calculated as 3.38 da in the first farm size group, 7.79 da in the second farm size group, 2.24 da in the third farm size group. Indeterminate tomatoes have been grown in the 7.29% of first size group, 12.70% of that of second size group, and 25.47% of that of the third size group. As general, 74.66%, 10.69%, and 14.65% of total farm land were managed by landowner, tenant, and sharecropper, respectively.

Farmers have grown indeterminate tomatoes as suitable to crop rotation. Type of rotation used widespread in the region is sugar beet - cereals - vegetables.

Fertilisation is needed to compensate lowered plant nutrients in the soil. Although soil scientists advice farmers to use fertiliser as a result of soil analysis, only 26.92% of farmers applied for soil analysis.

53.85% of indeterminate tomatoes growers obtained information related to soil analysis from Research Institute of Rural Services in the region. Other information sources are village group technicians (28.25%), and leader farmers (17.31%).

The ratio of farmers used fertiliser as result of soil analysis is 64.29. The rest (35.71%) used plant nutrients according to their experiences and by asking to relatives, neighbours, and leader farmers.

77.78% of farmers have explained that they had more product due to suitable fertilisation according to soil analysis. On the contrary, 22.22% of them said that the amount of fertiliser used according to the result of soil analysis is not sufficient.

90.38% of indeterminate tomatoes growers willing to be informed about fertilisation and soil analysis. The rest do not want any information and help about these.

Manure (organic) and Ammonium Nitrate (inorganic) are the types of fertiliser used too much as amount by farmers in the research area. DAP, TSP, Compound (8-24-8), Urea, and potassium Nitrate have followed them, respectively (table 2).

Table 2. Type and Amount of Fertiliser Used in Indeterminate Tomato Farming (kg / da)

Land Size (da)	Fertilisers						
	DAP	TSP	Urea	Compound (8-24-8)	Ammonium Nitrate	Potassium Nitrate	Manure (ton)
1 - 5	31.56	20.00	17.50	17.50	39.06	5.31	7.56
6 - 10	36.32	23.42	21.05	21.58	25.00	7.68	6.79
11 - +	23.82	32.35	22.06	21.76	30.88	11.18	5.82
General	30.77	25.29	20.29	20.38	31.25	8.10	6.71

As can be seen from table 3, farmers used 42.46 kg N/da, 44.47 kg P_2O_5/da, and 41.90 kg K_2O/da in indeterminate tomatoes growing. For indeterminate tomatoes growing, the level of fertiliser suggested by experts is 35.07 kg N/da, 74.13 kg P_2O_5/da, and 37.87 kg K_2O/da (Simsek and Sentürk, 1997). When fertiliser application of farmers is compared with the level of fertiliser application suggested by experts, it can be said that they used more nitrogen and potassium but less phosphorus per da. excess or less fertiliser use

leads to loss of product, loss of farmers' income and decreasing in the productivity of inputs.

Some farmers know that suitable potassium application to the soil and plant increase taste of product and lack of phosphorus cause yield declines, weakness of root system of plants. In addition, balanced nitrogen application helps increasing of bright appearance of fruits and vegetables but more use of nitrogen cause decreasing resistance of plants to climatic conditions, and diseases (Caglayan, 1983). Therefore, the application of fertiliser at the best time and quantity after soil analysis and according to suggestions of experts farmer is very important. FEEU has explained that if farmers use fertiliser according to suggestion level of experts, it is possible to increase the level of yield from 10-12 tons/da to 18-20 tons/da.

Table 3. Comparison of Farmers' Fertiliser Application with Level of Fertiliser Suggested by Farmer Education and Extension Unit

Land	Nitrate (N)			Phosphorus (P_2O_5)			Potassium (K_2O)		
Size (da)	1	2	3	1	2	3	1	2	3
1-5	44.88	35.07	+ 9.81	41.71	74.13	- 32.42	46.78	37.87	+ 8.91
6-10	42.42	35.07	+ 7.35	46.37	74.13	- 27.76	42.46	37.87	+ 4.59
11- +	40.22	35.07	+ 5.15	44.95	74.13	- 29.18	36.68	37.87	- 1.19
General	42.46	35.07	+ 7.39	44.47	74.13	- 29.66	41.90	37.87	+ 4.03

(1): Farmers' Application
(2): Level of Fertiliser Suggested by Farmer Education and Extension Unit (Simsek and Sentürk, 1997)
(3): Difference

Table 4. Harmony Between Level of Farmers' Fertiliser Application and Suggestions of Extension Unit

	Suggestions of Extension Units (Deviation from Mean $\bar{+}$ 10%)	With Suggestions			
		Harmonious		Inharmonious	
		No	%	No	%
Plant Nutrients	**Quantity of Fertiliser**				
N	31.56 - 38.58	11	21.15	41	78.85
P	66.72 - 81.54	7	13.46	45	86.54
K	34.08 - 41.66	5	9.62	47	90.38
Kind of fertiliser	**Time of fertilisation**				
DAP	Before planting (March-April)	32	86.49	5	13.51
TSP	Before planting (March-April)	27	90.00	3	10.00
UREA	With first cultivation (May-June)	18	66.67	9	33.33
Compound (8-24-8)	Before planting (March-April)	14	46.67	16	53.33
Ammonium Nitrate	During irrigation (June-July)	35	87.50	5	12.50
Potassium Nitrate	Irrigat../After each harvesting (June-ust)	17	62.96	10	37.04
Manure	During land preparation (Jan.-Febr.)	36	94.74	2	5.26
Kind of fertiliser	**Type of fertilisation**				
DAP	over soil and later mixing by cultivation	34	91.89	3	8.11
TSP	To band during time of seedling	25	83.33	5	16.67
UREA	To leaves, by sprinkling, band, to irr. water	24	88.89	3	11.11
Compound (8-24-8)	To band, by sprinkling	28	93.33	2	6.67
Ammonium Nitrate	To band, by sprinkling, to irrigation water	34	85.00	6	15.00
Potassium Nitrate	To band, to irrigation water	19	70.37	8	29.63
Manure	by sprinkling	38	100.00	-	-

Table 4 indicates that the level of nitrogen (78.85%), phosphorus (86.54%), and potassium (90.38%) used by indeterminate tomatoes growers is different from level of fertiliser suggested by extension unit. However, application of DAP (86.49%), TSP (90.00%), urea (66.67%), compound (46.67%), ammonium nitrate (87.50%), potassium nitrate (62.96%), and manure (94.74%) is in harmony with the suggestions of extension unit in terms of time of fertilisation. In the ratios of 91.89% in DAP, 83.33% in TSP, 88.89% in urea, 93.33% in compound, 85% in ammonium nitrate, 70.37% in potassium nitrate, and 100% in manure, farmers have used plant nutrients according to the suggestions of extension unit from point of view type of fertilisation.

It can be concluded that farmers used more fertiliser than the level of suggested. Unbalanced and unconscious fertiliser application by farmers may lead to environmental problems such as pollution of soil, water and air. Therefore, extension units should work efficiently about fertilisation due to environmental conservation, economic, and social reasons.

Table 5. Farmers' Fertiliser Use According to the Educational Level of Farmers and Comparison of Farmers' Fertiliser Application with Suggestions of Extension Unit (kg/da)

	Level of Education					
	Illiterate	NE(*)	Primary	Secondary	High school	General
Nitrogen						
Harmonious : No	---	---	5	2	4	11
: %	---	---	18.52	28.57	33.33	21.15
Inharmonious: No	3	3	22	5	8	41
: %	100.00	100.00	81.48	71.43	66.67	78.85
Total : No	3	3	27	7	12	52
:%	100.00	100.00	100.00	100.00	100.00	100.00
Degree of Freedom: 4, $X^2 = 5.29$, $P < 0.05$, Result: Level of Difference is not significant						
Phosphorus						
Harmonious : No	1	---	3	1	2	7
: %	33.33	---	9.68	16.67	22.22	13.46
Inharmonious: No	2	3	28	5	7	45
: %	66.67	100.00	90.32	83.33	77.78	86.54
Total : No	3	3	31	6	9	52
: %	100.00	100.00	100.00	100.00	100.00	100.00
Degree of Freedom: 4, $X^2 = 3.69$, $P < 0.05$, Result: Level of Difference is not significant						
Potassium						
Harmonious : No	1	1	2	---	1	5
: %	33.33	33.33	6.67	---	10.00	9.62
Inharmonious: No	2	2	28	6	9	47
: %	66.67	66.67	93.33	100.00	90.00	90.38
Total : No	3	3	30	6	10	52
: %	100.00	100.00	100.00	100.00	100.00	100.00
Degree of Freedom: 4, $X^2 = 4.33$, $P < 0.05$, Result: Level of Difference is not significant						

NE (*) attending a course but not having a primary school certificate

As can be seen from table 5, farmers having high educational level have used more fertiliser than the suggested level of extension unit.

As a result of Chi-square, it has been determined that there was no statistically relationship between the level of farmers fertiliser use and their educational level. That is, educational level of farmers do not affect the level of farmers' plant nutrients use.

3.2. Relations of Farmers with Extension Staff

The degree of relationship between farmers and extension personnel is very important in terms of making true or wrong application in practice. Therefore, the frequency of meeting of farmers with extension staff has been investigated. Although 5.77% of farmers have been visited by extension staff once a week, 53.85% of them only 2-3 times a year (table 6). The frequency of meeting of extension staff with farmers is low, too. For example, 13.47% of farmers have not met with extension staff, so far (table 7).

Table 6. Frequency of Being Visited of Farms by Extension Staff

Frequency of Visiting	Number	%
2-4 times a week	---	---
Once a week	3	5.77
Once 15 days	10	19.23
Once one or two months	11	21.15
2-3 times a year	28	53.85
Total	52	100.00

Table 7. Meeting (Come across) situation of Farmers with Extension Staff at Village

Meeting Situation	Number	%
at each visit	8	15.38
when farmers have problem	17	32.69
Generally	12	23.08
Rarely	5	9.61
When they come across	3	5.77
Nowhere/nowhere/None	7	13.47
Total	52	100.00

59.62% of farmers have gone to the office of extension staff when they have had some problems related to fertiliser and fertilisation. Ratio of farmers who have not met with the extension staff at his/her office to ask questions and get advice is 9.61% (table 8).

Table 8. Meeting (Come across) situation of Farmers with Extension Staff in the City or County

Meeting Situation	Number	%
when farmers go to city	2	3.85
when farmers have problem	31	59.62
Generally	1	1.92
Rarely	13	25.00
None	5	9.61
Total	52	100.00

Table 9 shows that farmers obtained information about fertilisation and kind of fertiliser from rural society (36.54%), extension unit (21.15%), and private fertiliser seller

(42.31%). These figures indicates that extension unit has no enough effect about farmers' fertiliser application and it does not form a good information source.

Table 9. Source of Information of Farmers about Fertilisation

Source of Information	Number	%
Extension staff of Directorate of Agriculture in City or County	11	21.15
Private Fertiliser Seller	22	42.31
Relatives- Neighbours- Leader Farmer	19	36.54
Total	52	100.00

As a conclusion, it can be said that indeterminate tomatoes growing is an innovation for farmers in the research area. The level of farmers' fertiliser application is not harmony with the suggestions of extension staff. However, farmers use plant nutrients at the advised time and style of suggested fertilisation. It has been determined that the contact of farmers with FEEU is not sufficient. And also, extension units were not efficient sources of information about fertilisation. As parallel to these indeterminate tomatoes growers do not have enough information about soil analysis and fertilisation. To help farmers about these problems research laboratories should be equipped with modern techniques and extension staff should inform and educate farmers about innovation, soil analysis and the best fertiliser application. Socio-economic characteristics of farmers and resources in the basis of farmers' behaviour should be analysed clearly. Economic loses caused by wrong agricultural applications can be minimised by developing the ability of farmers about comprehending, solution and questioning of problems.

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