How can Agricultural Extension System in Turkey be Sustainable?

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Abstract: In the study, extension services were examined through interpretation of data collected up to 1104 public and contracted extension workers. Turkish extension system is influenced by general and training-visit approaches which were employed in the past. The approaches employed are mainly directed to conventional production and yield increases using a top-down process and gives little place for human resources development and sustainable agriculture within Turkish extension system.

Keywords: Agricultural extension; technology transfer in agriculture; sustainable extension

Introduction

Agricultural extension has contributed to agricultural production and development within the past century. Extension also has an important role in sustainable development and international trade competition with today's knowledge based globe (Van der Bor, Brydan, Fuller, 1995; Csaki, 1999). Extension systems require decentralized, pluralized, client orientated and sustainable structures for adapting to today's improvements (Wagemans, 1990; Roling, 1989).

Agriculture takes a considerable part in Turkish economy with a 9% share in GNP, 29.5% share in employment, and 4.25% share in the export value (http://www.tuik.gov.tr). Public extension activities in Turkey are dominated and conducted by Ministry of Agriculture and Rural Affairs (MARA). Besides public financed, through the radical transformation on the financial support of farmers in agricultural extension was planned by "Village-Centered Agricultural Production Support Project" (KOYMER) in 2004. The first year salaries of advisors were completely paid by government but to additional government payments, farmer contributions were objected as 5% and 10% shares in following two years of the project. At the end of KOYMER project, a new project which is titled as "Development of Agricultural Extension Project (TAR-GEL)" has been implemented on 1th of January 2007. All KOYMER extension workers have been employed as contract based in public extension organizations (TEDGEM, 2009; ZMO, 2005).

Present farming systems cause serious environmental problems. In many countries soil erosion and chemical pollution endanger the future of agriculture. Pollution of agricultural products limits the marketability of these products. These problems can only be tackled by collective decision making by farmers and other stakeholders (Van den Ban, 2005). The important components of sustainable development such as farmer participation, multi-actors cooperation, and the targets of extension had been examined for defining how sustainable the extension system in Turkey. For this goal, extension activities, objectives and target groups had been examined according to the regions. The other aspect in extension is financial sustainability unfortunately the farmers are mostly unwilling to pay for extension in developing countries. This reluctance causes to unsustainable activity and financial mechanism, and continue the public dominant structure in extension services. The study is focusing on extension activities directing to sustainable development.

Material and Method

The data have been taken from two formerly conducted researches on public extension services by Boyaci (2007) and contracted extension services by Boyaci and Arslan (2007) in Turkey. The purposive sampling for the selection of provinces according to agricultural zones for public extension services and although, all 1023 contracted advisors around the country were planned to including but, 566 of them filled the questionnaires. As the result, 538 public and 566 contracted totally 1104 extension workers participated in the study. The questionnaires were posted to the advisors addresses and/or extension organizations. Furthermore, up to 650 questionnaires were filled through mutually interviews. All field level technical staff who works to enhance the living standards of rural people was identified as extensionist/extension worker in the study. The data had been analyzed and interpreted by using statistical tests such as percentages, likert scale, Chi square, Kruskal Wallis, correspondence analysis and multidimensional scaling.

Regions	Frequency	Percent
Marmara	146	13.2
Ege	222	20.1
Mediterranean	83	7.5
Central Anatolia	158	14.3
Black Sea	236	21.4
Eastern Anatolia	107	9.7
South-Eastern Anatolia	150	13.6
Total	1102	100
Missing	2	--
Total	1104	--

Table 1: Sustainable extension (public and contracted advisors)

Result and Discussion

Extension coverage and expenditures

The level of extension coverage, as measured by the ratio of extension worker to farmer, widely differs according to countries and regions of the world. The worldwide average is about one extension worker for every 2000 economically active people in agriculture (less than 400 farmers in developed countries). It is supposed that extension organizations are able to reach only 10% of their clients in the world (Feder, et al, 1999, Swanson et al, 1989). According to the findings, each extension worker serves 437 farmers and 496 hectar of land (furthermore, one veterinarian/technician serves 9730.4 cattle and sheep) in Turkey.

Well-managed extension systems with adequate funding give relatively high rates of return on the financial investment. Optimally, it is suggested that at least 40% of an extension's budget should go for programming and operational costs to give extension personnel adequate resources for traveling, teaching aids, publications, and field demonstrations (Feder, et al, 1999; Swanson et al, 1989). Extension and research expenditures in EU Countries are higher than US$150 per farmer (DPT, 2003; Boyaci, 1996). In the research, annual extension (e.g. field trials, demonstrations, visual aids, etc) expenditures per farmer were calculated as US$1.6 respectively. By taking into consideration the total budget of the public extension organizations, the figure allocated per farmer reached to US$49.2 in Turkey.

Some Characteristics of extension staff

Age, education level, in-service training attendance, and occupational experience affect the performance of extension workers (Boyaci, 1998; Expere, 1974). The proportion of female extension personnel is considered as inadequate (FAO, 1990). According to the findings, in Turkey, the average age of an extensionist is 34.7, 26.2% are women and 65.6% of extensionists have farming experience. About 69% of the extension staff graduated from agricultural faculties and 15.3% of them have a master's and/or Ph degrees. English is widely spoken as foreign languages by the extensionists (Table 2).

Extension workers	Frequency	Percent
Public	538	48.7
Contracted in public	566	51.3
Total	1104	100.0
Gender		
Male	806	73.1
Female	296	26.2
Total	1102	100.0
Experience with farming		
Yes	723	65.6
No	381	34.5
Total	1104	100.0
Faculty graduated		
Agriculture	758	68.7
Veterinarian	134	12.1
Others	212	19.2
Total	1104	100.0
Master and/or Ph Degrees		
Yes	169	15.3
No	935	84.7
Total	1104	100.0
Spoken languages		
English	858	86.1
German	62	6.2
French	53	5.3
Others	23	2.3
Total	996	100.0

Table 2: Some personal characteristics of extension workers

Occupational satisfaction level of extension staff was found as low especially, economic reason was seen behind the result. This low motivation causes the limited farm/farmer visits during the extension activities. Unfortunately, ecology lessons attending level is low (2.6). According to the likert scale level of language proficiencies was found as 2.3. This level has negative effect on following the world agenda. The considerable numbers of extension workers face the social and political pressures during the activities (Table 3).

	None				very much
	1	2	3	4	5
Satisfaction level	21.4	19.7	27.6	15.6	15.8
Ecology lessons	26.6	23.5	24.9	14.4	10.5
Language proficiencies	31.9	28.3	25.4	9.7	4.8
To be under the social, political pressure	7.7	14.0	28.4	30.0	19.9

Table 3: The levels of some components of sustainable extension

Time allocated in extension

Extension staff should devote all their working time exclusively to agricultural extension activities. They should not be assigned regulatory or administrative duty. In this context, the number of farm visits and time spent for extension activities are important indicators for performance evaluation in extension organizations. For example, more than 100 farm visits (Expere, 1974), or 8-20 farm visits in a week (TOKB, 1987) are reported by different sources. Extension workers in European Union member states spend 75% of their

working time for farmer training activities (Boyaci, 1996). According to the findings, extension workers are responsible for an average of 5.6 different crops, spend 16 days for farm visits in a month; devote up to 52% of their time for farmer training in Turkey.

Targeted topics and groups

Extension workers mostly focused on profits form agriculture, emphasizing the need for inputs and market, and training for farmers. Social and biological aspects of sustainability (such as soil fertility) were scarcely mentioned (Lawrence, 1997). The initial focus of extension services is to improve basic agricultural practices such as plant protection, fertilization, etc. The reason behind these technical objectives aiming at intensification is the extension approach which is based on production and yield increase in Turkey. The priorities of extension workers can be summarized as production and yield increase, quality improvement, reduction of cost and others (Table 4).

Objectives	Frequency	Percent
Production and yield increase	654	63.6
Quality increase	115	11.2
Cost reduction	69	6.7
New/alternative crops	66	6.4
Farmers organizations	61	5.9
Environment	36	3.5
Marketing	27	2.6
Total	1028	100.0

Table 4: The objectives in extension

The findings show that human resource development or related topics have very limited share in Turkish extension system. According to the regions the objectives of extension are different (Table 5). For instance, while production and yield increases are seen important for South Eastern Anatolia, new/alternative crops for Central Anatolia, crop quality for Ege and Blacksea, finally environment for Ege are the important objectives of extension services in Turkey.

Furthermore, although 80% of the farms are small (Miran, 2006), the extension activities are usually directed towards the big (32.7%) and medium (34.6%) scale farms in Turkey. Women farmers (7.6%) and the poor (3.4%) are insufficiently taken consideration in extension. Small scale farmers have advantage on sustainable agricultural techniques such as ecologic farming, and integrated pest management etc. because of intensively requires manpower applications.

Regions	number	Mean rank	Chi-square	df	Asymp sig
Marmara	126	503.2	20.932**	6	.002
Ege	214	548.3			
Mediterranean	79	490.5			
Central Anatolia	155	555.7			
Black Sea	228	514.6			
Eastern Anatolia	100	498.7			
South-Eastern Anatolia	124	435.8			
Total	1026				

** □*<0.05*

According to the answers the share of extension activities is 49%; bureaucratic 29%; self education 13.9%; and other 8.1% in Turkey. Normally extension share must be higher for system effectiveness. As the result of multi-crop farming system in Turkish agriculture, extension workers are responsible for about 5.8 different crops and an adviser realizes 16 farm visits in a month. Education levels of farmers targeted is 5.7

years. Extension workers mentioned 37% of target farmers were under 40 years old. Middle age and male farmers are explained as more frequently target groups.
The 90s has already been called the environmental decade. It s important for extension to identify effective and efficient educational delivery systems of environmental issues (Radhakrishna et,al., 1991). According to the extension workers' explanations, farmers mostly demand information on plant protection but, environmental matters have very limited share (Table 6).

Topics consulted	**Frequency**	**Percent**
Plant protection	446	43.9
Cultivation	278	27.4
Economic topics	214	21.1
Fertilizing	54	5.3
Environmental topics	23	2.3
Total	1015	100.0

Table 6: The topics consulted by farmers

The topics consulted by farmers are changing according to regions. The plant protection applications are the most consulting in Marmara and Mediterranean Regions, furthermore, the farmers in Marmara Region also ask for more information about environmental topics (Table 7).

Investments on extension can be financed by adoption of innovations/advices (Strauss et al., 1991). Extension for sustainable agriculture is not a matter of passing on the message. It requires a learning process and change in mentality, for farmers and extensionists (Proost, 1994). According to the extensionists, 52.7% of the farmers accept the extension suggestions in Turkey. Traditionalism, insufficient farmers' circumstances, low education levels and limited information of farmers were mentioned by extension workers in the study as the reasons for low adoption levels. The adoption levels of extension advices are higher in Mediterranean, Marmara and Central Anatolia regions than the other regions (Table 8).

Regions	economy	Cultivation	Plant protection	Fertilization	environment	Total	Chi square	Df	P value
Marmara	26	30	65	5	2	128	51.764**	24	.001
Ege	46	53	89	8	7	203			
Mediterranean	8	20	44	5	3	80			
Central Anatolia	32	53	58	12	1	156			
Black Sea	40	57	109	18	2	226			
Eastern Anatolia	33	31	23	4	4	95			
South-Eastern A	29	34	56	2	4	125			
Total	214	278	444	54	23	1013			

*** □*<0.05*

Table 7: According to the regions the topics consulted by farmers (chi square test)

Regions	number	Mean rank	Chi-square	df	Asymp sig
Marmara	125	515.8	47.3876***	6	.000
Ege	199	469.7			
Mediterranean	75	687.1			
Central Anatolia	153	512.9			
Black Sea	216	443.1			
Eastern Anatolia	92	446.1			
South-Eastern Anatolia	125	487.3			
Total	985				

*** □<0.01

Table 8: The adoption level of extension advices, Kruskal Wallis Test

Program Preparation

The program guides the staff and gives the indicators to the managers for monitoring and evaluating of activities. Furthermore, the program helps to sustain coordination of different actors in agriculture (Oakley and Garforth, 1992). The focus of effective environmental management is the using of a systematic approach to planning, controlling, measuring, and improving an operations environmental effort (Harrison, 2002). Program preparing tendencies were not found at the intended level in Turkey. According to the likert scale as "*always to never (5 to 1)*", the average value of program preparing tendency of extension workers was calculated as 3.4. Approximately 20% of extension staff are not preparing program during their works. Today's complicated activities and relations necessitate strong coordination among the actors. To be relevant and responsive to client concerns requires regular feedback at each level throughout the extension systems. Public dominant structure is restricted to contributions and relations with private companies and chambers of agriculture in the extension system. In the study, less than 5.0% of extension staff was declared to influence the local and farmer organizations on extension.

Employed extension approaches

The approaches guide the objectives, programs, clients, linkages, methods, and financing components of extension (Axinn, 1988). The Ministry and the National Research Institutes have dominantly directed the priorities and the information flows in developing countries. The new approaches in world agenda encourage farmer participation in extension programs as analyzers and problem definers and thus, help sustainable development (Rogers, 1993; Chambers, 1994).

The most effective, pedagogic way to come to an understanding of complex issues is "learning by doing", "action learning", and "discovery learning". All these principles stress the need to get involved in action and debate in order to build up experiences, share these with other people and learn more in an iterative process of action, reflection, self-evaluation and new action. Instead of being taught extension techniques, farmers are inspired to analyze their situation together, to put forward and try out their own ideas and known technical options. These experiences and lessons are then shared with other farmers and the larger community (Hagmann et al,1997). Extension workers intensively designate farmer problems via individual observations and/or interviews but, there is limited farmer participation in analyzing and problem solving processes in Turkey. This limited collaboration between actors is caused the low adoption rate of advices in extension system. Extension must understand the needs and problems of its clientele so it can select the appropriate information to help farmers understand their short and long term goals and provide them with tools for problem solving. The problems and the solutions are intensively decided by advisors themselves (Table 9). Human resources development approaches as the basic for sustainable development are insufficiently employed by extension services.

Statements	**Frequency**	**percent**
I and farmers jointly define the problems and but I find the solutions	*404*	*40.3*
Farmers tell the problems I find the solutions	*248*	*24.7*
I and farmers jointly define the problems and we also find the solutions jointly	*239*	*23.8*
I define the problems and I find the solutions	*112*	*11.2*
Total	*1003*	*100.0*

Table 9: The statement identified on the problem definition process in extension

The regions and sustainable extension system

Turkey's agricultural extension policy does not specifically focus on introducing sustainable agricultural production practices into the agricultural system. Existing efforts on sustainable agricultural production methods are mentioned as limited and nonsystematic (Kumuk and Akgungor, 1995). The significant

variables for sustainability and performance increasing in the system were used in the multi-dimensional scaling analysis for examining the similarities of the regions. The variables can be divided in three groups such as individual characteristics of extension workers, cooperation with local actors and extension activities (Table 10).

Individual characteristics	Cooperation with local actors	Extension activities
Occupational experience	effect of cooperatives	Devoted time for extension
Language proficiency	effect of chamber of agriculture	Devoted time for bureaucratic works
attending to sociology class	effect of local administration	Devoted time for self-learning
attending to extension class	effect of farmers	Crop numbers
attending to ecology class	harmony with the chambers of agriculture	Numbers of farm/er visit
Occupational satisfaction	harmony with the cooperatives	40 and younger farmers served
	problem discussion with the farmers	41 and elder group of farmers served
	harmony with the farmers' priorities	Education levels of farmers
	harmony with the farmers' conditions	advice adoption level of farmers
	individual interviews	to be under the pressure
		program preparing

Table 10: The variables using for Multidimensional Scaling (MDS)

According to these variables the regions have been grouped by multi-dimensional scaling (Stress = ,03813; RSQ = ,99725) as Marmara, Eastern, Blacksea and Central Regions (Group I); and the Southeastern, Ege, and Mediterranean Regions (Group II). The average situation of Turkey (TR) has taken place within Group I as shown in the model. During MDS an ideal region has been established for comparing the existing and objected/idealized situations. The exist situation in both region groups are quite far from the idealized situation of extension sustainability (Figure 1).

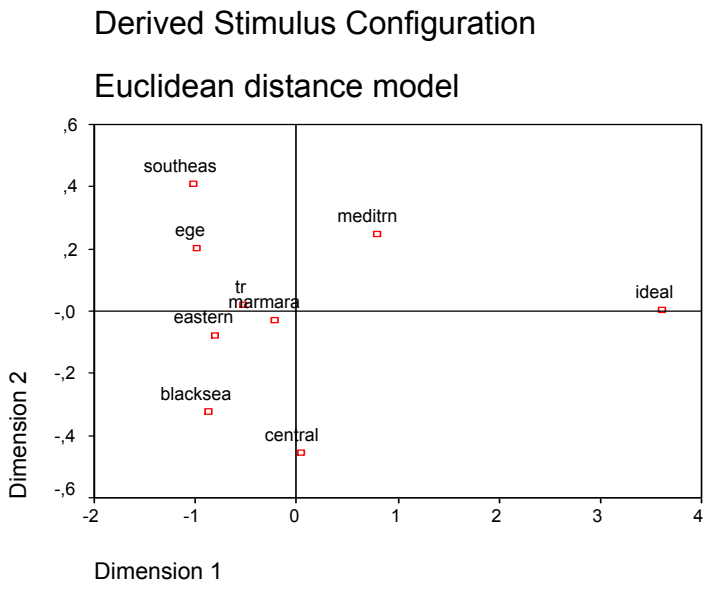

Figure 1: Region groups (MDS)

Mounting environmental problems call for new elements in our higher education curricula. Students should not only gain awareness of the environmental aspects related to their own discipline but should also acquire the ability to apply their specialist knowledge and understanding in multidisciplinary teams (Barendse and Hoek, 1996). For reaching ideal situation, individually extension staff must be well educated on sustainable farming practices and participatory extension approaches. Local participation is seen as the main

requirement for system sustainability. Farmers take place not only problem defining but also, solution finding phases. Extension is long term process and needs regular following of farmers' applications and extension advices. As a result of these devoted times for self learning and extension activities are important components of extension performance.

Conclusion

In a rapidly changing world, farming is becoming increasingly knowledge intensive activity that requires transformation on concepts and approaches of rural development. In this context future extension systems are assumed to be decentralized with highly skilled facilitator at the local level, and likely to be expanded to include various actors with different interests. The improvements in agricultural development approaches and alternative systems are not just a question of technology there are important social, economic and institutional issues as well (Roling, 1993). Extensions mission is to develop an integrated and multidisciplinary education plan that focuses on helping its clientele implement sustainable agricultural systems. In addition, Extension must design a program to meet the challenges of producing an abundant, healthy food supply while maintaining the quality of life and preserving natural resources (Ball, 2007).

Sustainable extension has two dimensions as system working and objectives. Fiscal sustainability has been a generic problem for large-scale agricultural extension systems in developing countries high-cost national systems have been significantly scaled down or discontinued altogether in large part because the fiscal demands they placed on public budgets were not sustainable (Quizon et al, 2001). In both, Turkish extension system is not at intended level. Neither financing nor planning phases are not included the farmers in Turkish extension system. While the activities have directed to conventional farming, the small farmers, women and disadvantage groups also have very limited priorities in the system. In briefly, low technology adoption levels, intensifying on only production increase, limited local participation have been emphasized as the common disorders.

In short term, public extension has to give place for ecological farming and sustainable development and both systems have to intensify on capacity building. Basically, the actors must have metamorphosis on utilizing approaches via participatory learning and sustainable basis. Based upon the findings and recent improvements in the world agenda, some suggestions can be made for developing countries and sustainable development in agricultural extension as follows:

1. Sustainable agriculture needs extensive consultation with the local actors.
2. The local actors not only take place but, must stay on the table in all stages of extension.
3. By considering the locations more flexible and participatory approaches must be employed in extension system.
4. Fundamentally, 15-20 extension workers must be trained on sustainable farming and participatory approaches as the core team for each province.
5. Sustainable farming practices, environmental management, health and safety farming skills are addressed as top priorities during the planning phase.
6. Agricultural chemical usage is not the only solution to farming problems, and farmers need to develop better understanding of diseases and their control. This needs to employ participatory approaches for collectively analyzing and creating the problems and their solutions.
7. The planning is important element of extension works. The activities should be based on the plan. The plans should include improved farming practices covering reduced cultivation/tillage, reduced fertilization and efficient water usage besides "clean" produce (Anonymous, 2000). The plan should be prepared locally and in a holistic manner.

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Determination of Stomata Densities of Some American Grape Rootstocks in Eğirdir/Isparta

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Abstract It was aimed to determine stomata density of 10 different American grape rootstocks (5BB, 110R, 99R, SO4, 1616C, Rup. Du Lot, Harmony, Fercal, Dodridge, Ramsey) which were located in Eğirdir Horticultural Research Institute in this research. On leaves on 6th node of shoots for each rootstock were collected to determine stomata density in July. Preparations were made using nail varnish on five different parts of leaf. Stomata numbers were counted from area of 0.066 mm^2 by using 10 x 40 magnification of light microscope. The results converted to number of stomata/mm^2. Stomata density changed between 61 and 141 stomata/mm^2. The lowest and highest stomata density was obtained from Rup Du Lot rootstock with 61 stomata/mm^2 and Ramsey rootstock with 141 stomata/mm^2 respectively.

Introduction

Stomata has an important role in epidermis tissue for plant gas taking and giving. They have already different from epidermis cells. They occur from two cells in shape of bean or kidney. These two cells convex surfaces come together and form stomata cell (Vardar, 1969). Stomatas can be found in the all parts of the plants except roots. Stomatas are small pores and generally can be found in epidermis tissue (Kaçar, 1989). Stomatas make gas diffusion by perspiration with cellular cavities and they control water and plant ratio in plants. Stomatatas in the leaves have an important role in adaptation to environmental factors (Salisbury, 1992).

Stomata means "mouth" in Greek language. Stomatas have important roles in photosynthesis and perspiration in plants. Stomatas can be found in plant tissues and especially they can be found in the bottom surface of *Vitis* leaves. They are in anomocytic type and surrounded by neighborhood cells (Ağaoğlu, 1999). Stomata density can vary according to plant species, varieties, ecology and cultivation practices. Stomata density can be affected by exogenous and indigenous factors (Kaiser, 2001). Leaf maturity and position of the leaves on the shoots affect stomata density (Düzenli and Ağaoğlu, 1992). 1.000 – 60.000 stomata can be found generally in 1 cm² leaf surface depending on plant species and environment. Stomata number can change for same plants which are grown greenhouse and natural conditions (Bozcuk, 1997). Stomatas take CO2 for photosynthesis and also take out water with transportation. Transpiration affects root pressure and prevents leaves from excess heating (Eriş, 1992).

Breeding *Vitis* studies main aim is to increase resistance for drought. Drought resistance is thought to occur from using water efficiently and proportion photosynthesis to transpiration (Duering, 1999). Grapevine is a mezofit plant but like ksefofit plants. It is resistant to drought that it can be caused by intense stomata density and resistant to drought tolerance correlation (Düzenli and Ağaoğlu, 1992; Kara and Özeker, 1999; Maraşalı and Aktekin, 2003). Also it is known that mesofit plants abscisic acid high levels are more effective for drought tolerance than kserofits. Some varieties can have different stomata number in natural conditions and green house conditions. This event strengthens the thesis about environmental factors affect the stomata number. Plants which are grown in drought conditions it is more important to evaluate their stomata densities according to the variety and ecological conditions.

This study was conducted to determine stomata numbers of 10 different American Grape rootstocks (5BB, 110R, 99R, SO4, 1616C, Rup Du Lot, Harmony, Fercal, Dodridge, Ramsey) in Eğirdir ecological conditions.

Material and Method

This study's main material was 10 different American grape rootstock (5BB, 110R, 99R, SO4, 1616C, Rup. Du Lot, Harmony, Fercal, Dodridge, Ramsey) which were cultivated in Eğirdir Horticultural Research Institute.

Position of leaf on the shoot affects stomata number (Düzenli and Ağaoğlu, 1992). For this reason each rootstock's leaves were taken from the sixth node (same for all varieties) in July. Leaves were taken from same thickness of shoots with 10 replicates. Colorless nail vanish was used in order to extract samples from the leaves. Samples were prepared from different places on the leaves. Nail vanish was dripped 1-2 drops on the bottom surface of leaf and when it was dried, it was taken off like a pattern form the leaf by the help of a gillette. After the sample was put on a lam and 1-2 water drop was dripped on lam, was covered with lamella (Mısırlı and Aksoy, 1994). Stomata count was done in a 0.066 mm² area by a light microscope with 10X40 magnificent. Stomata numbering 1 mm² was calculated from proportional calculation. Counted stomata numbers were statistically analyzed by Jump software programme.

Results and Discussion

Stomata density changed between 61 and 141 stomata /mm^2. The lowest and highest stomata density was obtained from Rup. Du Lot rootstocks with 61 stomata /mm^2 and Ramsey rootstock with 141 stomata /mm^2 respectively as seen in table 1.

Rootstock name	Stomata density (number/mm^2)
Ramsey	141
110 R	136
Dodridge	133
99 R	132
5 BB	131
Fercal	117
1616 C	108
Harmony	98
SO 4	90
Rup Du Lot	61

Table 1. Rootstock stomata density in a 1 mm² area

First stomata number researches in *Vitis* species have been started in 19th century last times. First study about stomata number of *Vitis* was Müller-Thurgau's "Ampalographische Berichte" in 1882. He counted "Riesling" variety that it had 186 stomata/mm² on the bottom of the leaves (Oraman,1972).

Düzenli and Ağaoğlu (1992), found that Razakı grape variety had more stomata number than the other varieties. Razakı grape variety can be grown in different ecological conditions. Razakı variety may be more resistant than other varieties for drought. Other studies showed that stomata number could vary according to ecological conditions. For example Çavuş grape variety stomatas were counted 187 stomata /mm² in Marmara and 277 stomata /mm² in Ankara ecological conditions (Eriş and Soylu 1990). Hegedüs (1974) determined that stomata numbers and volumes could vary in the different places of same plant. He determined that stomata numbers of some varieties Sultani Çekirdeksiz 216, Hafızali 194, Portugieser 206, Pinot Gris 164, Weisse Gutedel 183, Müller Thurgau 158, 5 C rootstock 209, Rup Du Lot'da 171, Portalis'de (*Vitis Riparia*) 194 stomata/mm². Duering (1980) counted the mature leaves of *Vitis rupestris*

and *Vitis cinerea* and determined 174 stomata /mm² and 349 stomata /mm² respectively. They determined that stomata number could rarely vary in the same plant's same leaf. Scienza and Boselli (1981), studied about stomata dimensions and they reported that stomata dimensions can be affected from the genotype and position of the leaf on the shoot. Biggest stomata numbers were 1103 P and 3309 rootstocks, 157-11C and 140 R had the lowest stomata number. They determined the stomata number differences between grape varieties and rootstocks. When stomata numbers are counted according to leaf maturity, young leaves have more stomatas than mature leaves. Also it was reported that if there wasn't a much water stress, irrigation conditions wouldn't have an important effect on stomata number (Marasalı and Aktekin, 2003). It is necessary to research ABA synthesis and like similar factors about stomata density for drought resistance.

Yuvarlak çekirdeksiz grape variety grafted on 99 R and 110 R rootstocks had been determined 284.4 and 294.8 stomata numbers respectively. Stomata numbers were determined more than grafted on the other rootstocks.

Stomata number had been evaluated statistically important in this study. Stomata number differences had been evaluated also in different studies. For example in a study *Vitis* species stomata densities had been determined and average stomata number had been found 198.3 stomata /mm². Stomata density of *Vitis berlanderi* was determined 143.6 stomata /mm² and *Vitis cardifolia* was determined 302 stomata/ mm². Stomata density of *Muscadinia rotundifolia* was determined 407.7 stomata /mm². Diploid's average stomata density was 182.4 stomata/mm²and tetrapolid's average stomata density was 114 stomatamm² (Shiraishi and et. all 1996).

Jump software programmes analyse results are given in below.

Source	**DF**	**Sum of Squares**	**Mean Square**	**F Ratio**
Model	9	36116,254	4012,92	17,0262
Error	39	9191,950	235,69	**Prob > F**
C. Total	48	45308,204		<,0001

Table 2. Analysis of Variance

Level					**Least Sq Mean**
RAMSEY	A				141,60000
110 R	A	B			136,20000
DODRİDGE	A	B			133,25000
99 R	A	B			132,60000
5 BB	A	B			131,20000
FERCAL		B	C		117,20000
1616 C			C		107,80000
HARMONY			C		98,00000
SO 4				D	70,20000
RUP DU. LOT				D	60,80000

Table 3. Groups of LSD Test Levels not connected by same letter are significantly different.

Conclusion

Some grape rootstocks had been evaluated for stomata density in this study and rootstocks had been found statiscally significantly important for stomata density. Stomata density may vary according to ecological conditions and cultivation practices in *Vitis*. Stomata density gets higher by losing water with transpiration but it has not been proved clearly up to now. But sometimes it is seen that stomata density get high in irrigated conditions. Stomata density researches must be continued because of these reasons. Stomata numbers and densities must be evaluated and expect stomata density, stomatata pores, stomata index, transpiration ratios distances between stomatas must be evaluated. Drought resistance and stress

studies are getting more important in nowadays stomata studies with plant physiology must be done continuously with the other subjects concerning stomata.

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