International Journal of Environmental Trends (IJENT)
http://dergipark.gov.tr/ijent
International Journal of Environmental Trends (IJENT)
2019; 3 (2),151-158
ISSN: 2602-4160
Turkish JournalPark ACADEMIC

Research Article

The Quantitative Effects of Different Growing Media on the Seedling Growth of Aubergine (*Solanum melongena* L.) and Cucumber (*Cucumis sativus* L.) in Autumn

Murat Demirsoy[1], Sezgin Uzun[2]

[1*]Sarayönü Vocational School, Selçuk University, Konya, 42003, Turkey,

[2]Ondokuz Mayıs University, Faculty of Agriculture, Department of Hort., Samsun, Turkey.

Abstract

The objective of this study was to examine the availability of some materials namely, forest soil, ash (firewood), charcoal, chicken manure, sheep manure, cow manure (decomposed), which can be easily found in Turkey. The vegetable crops tried were aubergine (Aydın siyahı) and cucumber (Beta 309 F1). The effect of growing media on the growth of seedling was found to be different depending on the species. In the study with forest soil and peat (GM1 and GM3) was ascertained that leaf dry weight (LDW), root dry weight (RDW), plant dry weight (PDW), total leaf area (TLA), leaf weight ratio (LWR), root weight ratio (RWR), stem weight ratio (SWR) and leaf area ratio (LAR) increased for aubergine during autumn season. This is similar to the increased in leaf dry weight (LDW), stem dry weight (SDW), root dry weight (RDW), plant dry weight (PDW), total leaf area (TLA) and leaf area ratio (LAR) of media named GM1 and GM3 applied for cucumber during autumn season. The results obtained from the present study showed that the most suitable growing media were the media named GM1 (forest soil) and the media named GM3 (a mixture of forest soil and peat) for aubergine and cucumber during autumn season.

Received
13 February 2019

Accepted
30 November 2019

Keywords
Growing Media, Seedling quality, Seedling cultivation, Growth

[1]Corresponding Author Email: mdemirsoy@selcuk.edu.tr

1. INTRODUCTION

One of the most important issues affecting the success of vegetable growing to produce quality seedlings [1, 2, 3]. The substrate composition is very important for seedlings. The physical properties and chemical composition have both a considerable effect on plant growth rate of young plants [4]. Although seedling production is commonly used many countries, the desired level of seedling production in terms of the appropriate media and mixtures have not been reached The researchers focused on the usefulness of seedlings growing regional organic waste [1, 5]. Growing media is usually made from a mixture of organic materials and inorganic materials [6, 7]. Peat, due to favorable physical characteristics and high cation exchange capacity is used widely [8] Farmers sometimes produce seedlings growing medium. However, they cannot take adequate measures against weed seeds, diseases and pests [9]. However, began to search for alternative materials due to major damage to the natural environment and the limited supply of peat [10, 11].

In our country, it could not develop an appropriate fee to the standards for the production of vegetable seed and seedling mortars, constitutes one of the major problems manufacturers. For this purpose, a seedling growing medium mixture prepared by different researchers, in the cultivation of different types of vegetables. Plant growth, earliness, yield and growing media were determined to make a positive impact on the quality of advice to the producers [12]. As a result of mistakes made in the preparation of seedlings grown in medium; seedlings, seeds, time, labor and causes a loss of product [7].

Quality seedlings; must have a balanced stem-root ratio, should have a high degree of total dry matter, nodes interval should be short, stem should be thick, leaves should be green and thick, it must have sufficient root growth, all parts must be strong and healthy, such as specific color characteristics must be evident, should not be too young or old and all the seedlings should be homogenous [13, 14, 15, 16]. Quantitative indicators of these criteria have been examined in our study. Therefore, the seedlings of vegetables growing medium should be the ideal mix enough to meet the request. Prepared seedlings growing media can be useful for others, although it is useful for a plant. In this respect to meet the demands of the majority of vegetables by making various preparations are needed to determine the ideal seedling growing media or separately optimal growing media for each type of seedling. This study; preparing seedlings of different environments, with different types of vegetables the growing medium (aubergine and cucumber) seedling quality, by determining their effects on seedling growth and development were studied to determine the most appropriate medium.

2. MATERIAL AND METHODS

In this study, the plant material "Aydin siyahı" aubergine and "Beta 309 F1" cucumber varieties were used. The type of material on the properties of seedling growing media and grain size is effective. Therefore, selecting one group of various materials in the desired size and mixed in suitable proportions multiple materials can be accessed on the intended properties. As the seedling growing media; forest soil ready for commercial peat, natural peat, wood ash, coal dust, chicken manure, sheep manure, cow manure, garden soil, hazelnut husk slag, pine needle and perlite materials were used. Commercial peat was used as control application. Also, fertilization was not performed on seedlings growing medium. The material used seedling growth medium mixture and the mixture ratios are given in Table 1.

Table 1. Mixing ratio of the seedling growth mediums used in the experiment.

Media	Material mixtures
GM1	Forest Soil (Pine forest)
GM2	Commercial Peat (Control)
GM3	1 Part Forest Soil + 1 Part Commercial Peat
GM4	1 Part Garden Soil + 2 Part Cow Manure
GM5	1 Part Forest Soil + 1 Part Sheep Manure + 1 Part Cow Manure + 1 Part Chicken Manure + 1 Part Ash + 1 Part Coal + 1 Part Pine Needle + 1 Part Hazelnut Husk Slag
GM6	1 Part Forest Soil + 1/3 Part Ash + 1/3 Part Coal + 1/2 Part Pine Needle + 1/2 Part Hazelnut Husk Slag
GM7	1 Part Forest Soil + 1/3 Part Sheep Manure + 1/3 Part Cow Manure + 1/3 Part Chicken Manure + 1/3 Part Ash + 1/3 Part Coal + 1/2 Part Pine Needle + 1/2 Part Hazelnut Husk Slag
GM8	1/3 Part Ash + 1/3 Part Coal + 1/2 Part Pine Needle + 1 Part Hazelnut Husk Slag
GM9	1/3 Part Sheep Manure + 1/3 Part Cow Manure + 1/3 Part Chicken Manure + 1/3 Part Ash+ 1/3 Part Coal + 1/2 Pine Needle + 1 Part Hazelnut Husk Slag
GM10	1 Part Garden Soil + 2 Part Cow Manure + 1 Part Perlite
GM11	1 Part Garden Soil + 2 Part Cow Manure + 1/2 Part Hazelnut Husk Slag + 1/3 Part Ash + 1/3 Part Coal + 1/3 Part Sheep
GM12	1 Part Natural Peat + 1 Part Commercial Peat
GM13	1 Part Natural Peat + 1/3 Part Sheep Manure + 1/3 Part Cow Manure + 1/3 Part Chicken Manure
GM14	Natural Peat
GM15	1 Part Natural Peat + 1/2 Part Perlite + 1/3 Part Sheep Manure + 1/3 Part Cow Manure + 1/3 Part Chicken Manure

Seedlings were raised in module seed trays (45 cells 5*5 cm). Both plant species were the seed planting date 27 July. 50% shading were applied to seedlings until the date of planting. Nine seedlings have 4-5 true leaf is removed for analysis in each application and then plant dry weights were determined. Drying process was performed in the incubator (Nüve FN 500) at 80 ^{o}C for two days to determine the dry weight of different part of the plant (leaf, stem and root). The dry weights of the materials taken from the incubator were determined by weighing them on a precision scale (Chyo JL-180 (0,000lg)). Leaf areas of plant were measured by digital planimetry (Placom). Experiments were conducted in randomized blocks design with 3 replications and 9 plants in each replication. As a result of quantitative analysis, the formulas given in Table 2 were used in the calculation of plant growth parameters [17].

Table 2. The plants growth parameters for quantitative analysis.

Leaf weight ratio (LWR) = Total leaf dry weight (g)/Total plant dry weight (g)
Stem weight ratio (SWR) = Total stem dry weight (g)/Total plant dry weight (g)
Root weight ratio (RWR) = Total root dry weight (g)/Total plant dry weight (g)
Specific leaf area (SLA) (cm^2g^{-1}) = Total leaf area (cm^2)/Total leaf dry weight (g)
Leaf area ratio (LAR) (cm^2g^{-1}) =Total plant leaf area (cm^2)/Total plant dry weight (g)

The seedling health index was determined using the following equation [18] :

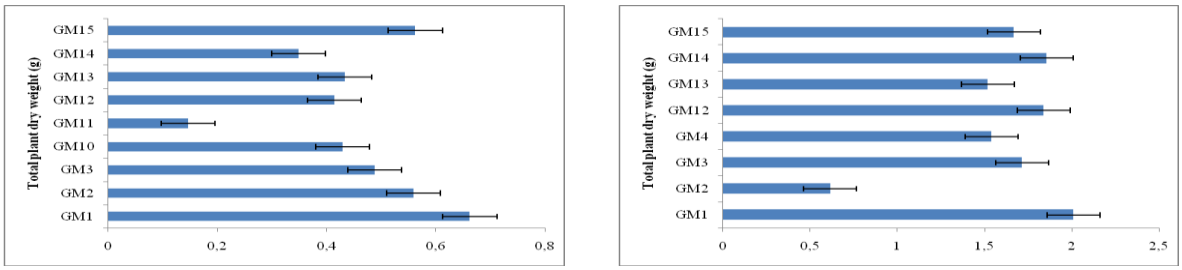
Seedling Health index= (Stem diameter/Stem height) * Dry weight

3. RESULTS AND DISCUSSION

For evaluation of research results, the highest results of seedling media are compared only.

3.1. Total plant dry weight (PDW)

Change of total plant dry weight of aubergine and cucumber seedlings of different growth media are given in Fig. 1, respectively. GM1 application for aubergine (0.66 g) and cucumber (2.01 g) showed the highest TPDW values (Fig. 1). Control application has reached a higher value than most of the growing medium in aubergine (Fig. 1a). Adding of mixtures of forest soil, seedling growing media was very effective in significantly increasing plant dry weight than the control plants in cucumber (Fig. 1b). In aubergine and cucumber showed significant increases in forest soil plant development. The results were notifications; Wang and Lin [19], adding half strength of 50% fertilizer to a mixture of 50% soil plus 50% compost was very effective in significantly increasing plant dry weight. According to Babaj, et al. [4] the cucumber seedlings grown in vermin compost had a higher dry matter compared with peat grown seedlings. It was reported by Uzun, et al. [20], the highest plant dry weight was obtained from the mixtures in the mixtures for decomposed farmyard manure, sieved garden soil, hazelnut husk, rice hull, sand of 2 mm, decomposed pine leaves, tobacco waste, coal ash and coal dust as ratios of 2:1:1:1:1/3:1:1/2:1/2:1/4. The highest leaf dry weight in aubergine was obtained from the plants grown in the mixture of decomposed farmyard manure, sieved garden soil and sand (2 mm) used in a ratio of 1:1:1.

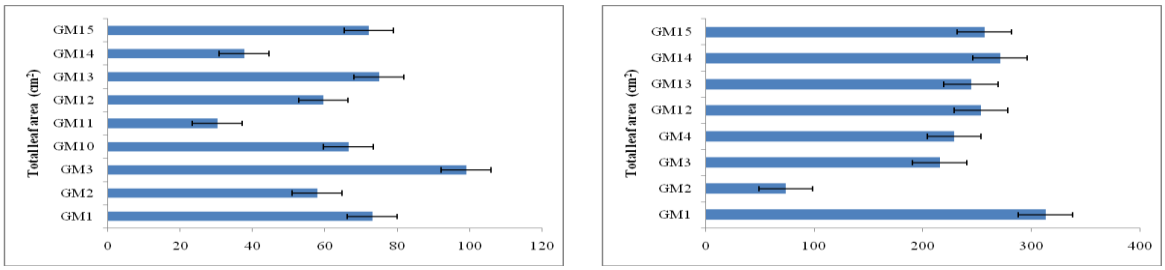


a b

Fig. 1. According to different seedling growing media the changes of total plant dry weight (TPDW) for aubergine (a) and cucumber (b).

3.2. Total leaf area (TLA)

Total leaf area of aubergine and cucumber seedlings of different growth media are given in Fig. 2. GM3 application showed the highest TLA values (99 cm^2) in aubergine (Fig. 2a). GM1 application showed the highest TLA values (312.53 cm^2) in cucumber. Similar to the total dry weight of the cucumber plant total leaf area value is quite high compared to the control (Fig. 2b).According to Jankauskienė and Brazaitytė [21], seedlings grown in peat are higher, have bigger leaf area than the seedlings grown in peat-perlite, peat-zeolite substratum, but in leaves and roots they accumulate less dry matter and plant fresh weight also is smaller.



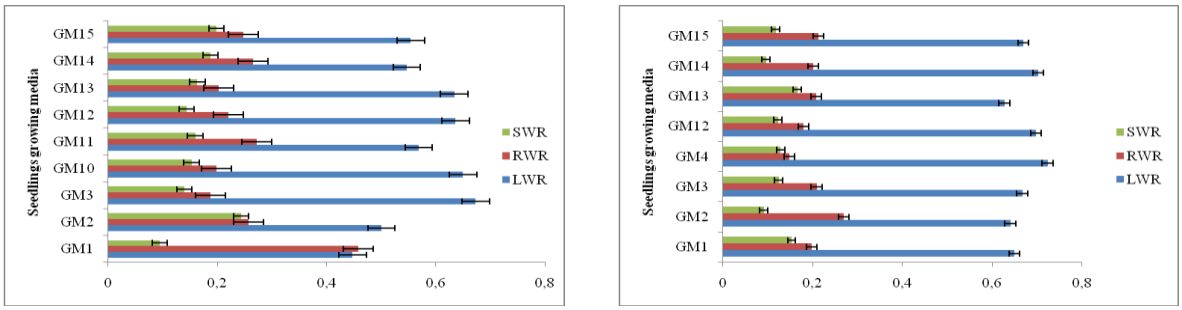
a b

Fig. 2. According to different seedling growing media the changes of total leaf area **(**TLA) for aubergine (a) and cucumber (b).

3.3. Evaluation of Plant Growth Parameters

3.3.1. Leaf weight ratio (LWR), Root weight ratio (RWR) and Stem weight ratio (SWR)

When Fig. 3a is examined, it is observed that the highest LWR, RWR and SWR were seen from the seedlings of the GM3, GM1 and GM2 mediums, respectively. As seen in Fig. 3b, the highest seedling LWR, RWR and SWR were obtained from the seedlings of the GM4, GM2 and GM1 mediums, respectively. According to Kandemir, et al. [22], the highest leaf weight ratio and root weight ratio was measured as 0.56, 0.15 from the seedlings respectively. These results were found similar for cucumber.

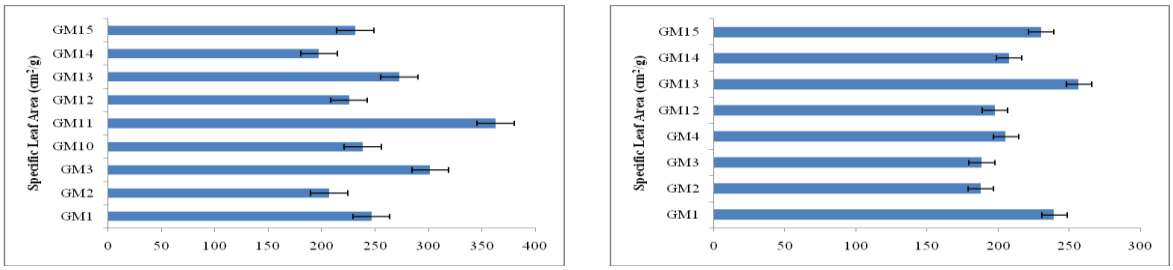


a b

Fig. 3. According to different seedling growing media the changes of leaf weight ratio (LWR), root weight ratio (RWR) and stem weight ratio (SWR) for aubergine (a) and cucumber (b).

3.3.2. Specific leaf area (SLA)

The highest aubergine seedling specific leaf area was determined in the GM11 medium as 362.65 cm^2/g, whereas the highest cucumber seedling specific leaf area was determined in the GM13 medium as 256.58 cm^2/g (Fig. 4). According to Kandemir, et al. [22], the highest specific leaf area (276.82 cm^2/g) were determined from the cucumber seedlings of the farmyard manure and garden soil (FYM+S) medium.

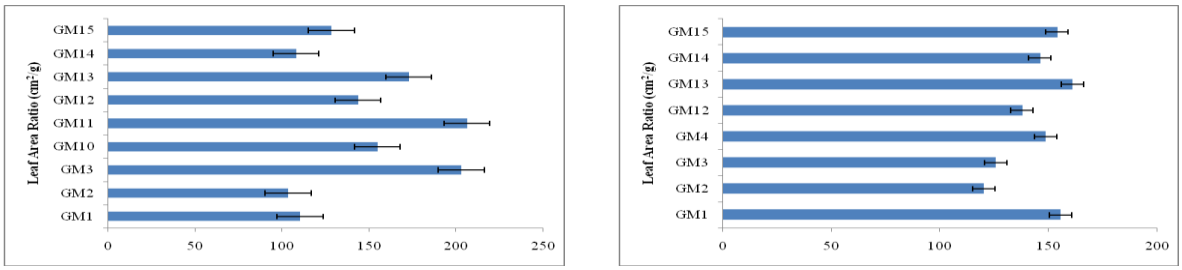


a b

Fig. 4. According to different seedling growing media the changes of specific leaf area (SLA) for aubergine (a) and cucumber (b).

3.3.3. Leaf Area Ratio (LAR)

The highest leaf area ratio (206.23 cm^2/g) for aubergine was determined from the seedlings of the GM11 medium (Fig. 5a). This value was obtained from GM13 medium for cucumber (Fig. 5b). According to Kandemir, et al. [22], the highest leaf area ratio (154.77 cm^2/g) were determined from the cucumber seedlings.

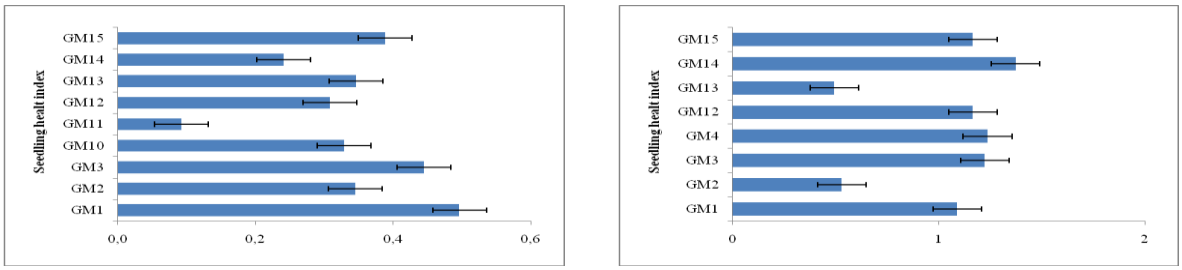


a b

Fig. 5. According to different seedling growing media the changes of leaf area ratio (LAR) for aubergine (a) and cucumber (b).

3.4. Seedling Health Index (SHI)

When Fig. 6a is examined, it is observed that the highest seedling health index of 0.5 was determined from the seedlings of the GM1 medium. This medium was followed by medium GM3. The lowest seedling health index of 0.09 was obtained from the seedlings of the GM11 medium. As seen in Fig. 6b, the highest seedling health index was obtained from the seedlings of the GM14 medium. Seedling health index is an important indicator of quality seedlings [18]. According to Jankauskienė and Brazaitytė [21], cucumber seedlings grown in peat-zeolite and peat-perlite substratum accumulated in leaves and roots more dry matter than the seedlings grown only in peat.



a b

Fig. 6. According to different seedling growing media the changes of seedling health index (SHI) for aubergine (a) and cucumber (b).

4. CONCLUSION

It was reported that the proportion of quality seedlings obtained from quality seeds and suitable seedling media mixtures were found to be 20-30% higher than those of the seedlings produced with less and seedling media quality [22, 23]. The mixture used at the beginning of seedling production is preferred that the light structured. In this regard, the seedling production the use of materials such as perlite, sand or peat is more appropriate. Potting mix materials should be different according to usage. In vegetable production will start with quality seedlings; Increasing the product yield and quality will be achieved. As a result of this study, it can be said that the seedlings produced in the medium which were the media named GM1 (forest soil) and the media named GM3 (a mixture of forest soil and peat) for aubergine and cucumber during autumn season.

Information: This study is a part from master thesis of Murat DEMİRSOY. In addition, dear academic researcher Prof. Dr. Sezgin UZUN died in 2014.

References

1. Sevgican A. Örtüaltı Sebzeciliği. Cilt IE Ü. Ziraat Fakültesi Yayınları No: 528. ISBN 975–483–384–2, İzmir; 1999.
2. Sevgican A. Topraksız Tarım. 3. Sebze Tarımı Sempozyumu. 2000:11-13.
3. Yanmaz R, Duman İ, Yaralı F, Demir K, Sarıkımış G, Sarı N, . . . Özalp R. Sebze üretiminde değişimler ve yeni arayışlar. Türkiye Ziraat Mühendisliği VIII Teknik Kongresi. 2015:579-605.
4. Babaj I, Kaçiu S, Sallaku G, Balliu A. The Influence of Different Substrate Composition on Growth Parameters and Dry Mass Partitioning of Cucumber (Cucumis sativum L.) Seedlings. IV Balkan Symposium on Vegetables and Potatoes 830; 2008.
5. Gül A. Topraksız Tarım Uygulamaları. Türkiye V Seracılık Sempozyumu, s. 1990:411-419.
6. Atiyeh R, Subler S, Edwards C, Bachman G, Metzger J, Shuster W. Effects of vermicomposts and composts on plant growth in horticultural container media and soil. Pedobiologia. 2000;44(5):579-590.
7. Bunt B. Media and mixes for container-grown plants: a manual on the preparation and use of growing media for pot plants. Springer Science & Business Media; 2012.
8. Raviv M, Wallach R, Silber A, Bar-Tal A. Substrates and their analysis. Embryo

Publications, Athens; 2002. p. 25-105.
9. Beckett KA, Beckett K, Carr D, Stevens D. The contained garden: the complete guide to growing outdoor plants in pots. frances lincoln ltd; 1999.
10. Alexander P, Bragg N, Meade R, Padelopoulos G, Watts O. Peat in horticulture and conservation: the UK response to a changing world. Mires and Peat. 2008;3(8).
11. Barkham J. For peat's sake: conservation or exploitation? Biodiversity and Conservation. 1993;2(5):556-566.
12. Uzun S. Sıcaklık ve Işığın Bitki Büyüme, Gelişme ve Verimine Etkisi (III. Verim). OM Ü Ziraat Fak Dergisi. 1999;15(1):105-108.
13. Álvarez S, Navarro A, Nicolás E, Sánchez-Blanco MJ. Transpiration, photosynthetic responses, tissue water relations and dry mass partitioning in Callistemon plants during drought conditions. Scientia horticulturae. 2011;129(2):306-312.
14. Davis AS, Jacobs DF. Quantifying root system quality of nursery seedlings and relationship to outplanting performance. New Forests. 2005;30(2-3):295-311.
15. Peter-Onoh C, Ngwuta A, Obiefuna J, Ogoke I, Orji J, Nwokeji E, . . . Abana P. Influence of growth medıa on the rate of emergence, growth parameters.
16. Sa'id A, Lere G, Yahqub M, Abdullahi H, Hamma I. Influence of nursery media and age of cutting on the performance of moringa (Moringa oleifera (L.) in Samaru, Zaria. Nigerian Journal of Agriculture, Food and Environment. 2015;11(3):70.
17. Uzun S. Sıcaklık ve ışığın bitki büyüme, gelişme ve verimine etkisi (I. Büyüme). OMÜ Ziraat Fak Dergisi. 1997;12:147-156.
18. Fan X-X, Xu Z-G, Liu X-Y, Tang C-M, Wang L-W, Han X-l. Effects of light intensity on the growth and leaf development of young tomato plants grown under a combination of red and blue light. Scientia Horticulturae. 2013;153:50-55.
19. Wang SY, Lin S-S. Composts as soil supplement enhanced plant growth and fruit quality of strawberry. Journal of Plant Nutrition. 2002;25(10):2243-2259.
20. Uzun S, Balkaya A, Kandemir D. The effect of different mixtures of organic and inorganic materials and growing positions on vegetative growth of Aubergine (Solanum melongena L.) grown in bag culture in greenhouse. Anadolu Journal of Agricultural Sciences (Turkey). 2007.
21. Jankauskienė J, Brazaitytė A. The influence of various substratum on the quality of cucumber seedlings and photosynthesis parameters. Sodininkystė ir daržininkystė. 2008;27(2):285-294.
22. Kandemir D, Özer H, Özkaraman F, Uzun S. The Effect of Different Seed Sowing Media on the Quality of Cucumber Seedlings. The European Journal of Plant Science and Biotechnology 2013;7 (Special Issue 1).
23. Günay A. Sebze Yetiştiriciliği. Cilt I. Meta Basımevi, 502s İzmir. 2005.