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Economic analysis of agrochemical use for weed control in field-grown celery: A case study for Turkey

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Abstract

Weeds are one of the major limiting factors for economically viable celery production. Agrochemicals are useful for control of weeds and their benefits may be estimated in terms of reduced crop losses. This study was conducted to analyse the farm-level economics of agrochemical use for weeds in celery grown in Izmir, Turkey. Data were collected from 24 farmers using a random sampling method. According to the results of the study, the treatment index of agrochemicals used for weed control varied between 0.48 and 1.60. The number of farmers who used a lot of agrochemicals for weeds was 9 (38%). The average usage of agrochemicals per hectare (as active ingredient) for weeds and all pests in celery production was estimated to be 1.76 and 1.90 kg/ha, respectively. The average agrochemical use and application cost was determined as $111/ha. Agrochemicals and their application costs formed 3.79% of variable costs and 2.90% of total costs, respectively. The share of the costs of weed control in total agrochemical costs for pests was 40.29%.

Keywords: Celery; Economic feasibility; Input use; Agrochemicals; Agricultural economics

1. Introduction

Celery includes several varieties of *Apium graveolens* and *A. rapaceum* as a cultivated vegetable or wild herb. It belongs to the family Apiaceae (Umbelliferae) and grows wildly in wet places throughout most of Europe. It was first cultivated in the Mediterranean region about 3000 years ago. The early plants were very primitive and were used primarily for medicinal purposes, such as sedatives. The first use of celery as a culinary ingredient was for flavouring, and the earliest printed record of a food use is from France, dating to 1623 (Burden, 2006).

Today, celery is a popular herb and vegetable in North America and Europe. In the US and the UK, celery varieties with fleshy stems are popular; in the European continent, celeriac varieties (root celery or turnip-rooted celery, var. *rapaceum*) are desired by consumers and are more commonly found in the marketplace. The central and south coastal valleys of California lead in the US in celery production, bolstered by ideal year-round growing conditions. Florida is number two, followed by Michigan, Texas, and Ohio, respectively. Americans use roughly 953 million kg of the vegetable per year, or about 3.3 kg per person annually. Plants that produce commercially distributed celery seeds, celery root (celeriac), and celery stalks are all different varieties. Celery is a relatively difficult vegetable to grow, requiring large amounts of water, cooler temperatures, and a long growing season for optimum flavour and texture.

Turkey (with 25 million tonnes) takes the fourth place after China, India, and USA in world vegetable production (FAO, 2007). In Turkey, vegetable production represents 21% of total plant production and 62% of horticultural production. Approximately 800,000 ha are used for vegetable production. The geographical conditions of Turkey allow almost all kinds of vegetables to be grown.

Approximately 10,000 ha area in Turkey is used for celery production. In 2004, the total celery production of Turkey was 18,200 tonnes, with a total crop value of $8.72 million. Turkey exported 168 tonnes of fresh celery valued at $141 million to EU countries in 2004. Exports are

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mostly to Greece, UK, Netherlands, Belgium, and France (EPC, 2004).

Good soil preparation prior to transplanting is essential to manage a celery crop for maximum yield and quality. Proper soil conditioning and levelling of fields prior to planting will provide the optimal environment for celery transplants. Weed control is an integrated practice including cultivation and use of agrochemicals. Crop rotation, pre-plant irrigation, and discing to remove weed seedlings reduce the potential for weed problems in celery; such practices will contribute to overall weed management throughout the production season.

Control of weeds is accomplished through good weed management in celery, and/or residual control provided by fumigations. It cannot be understated that the planned phase-out of methyl bromide in rotational crops will indirectly impact weed problems encountered in celery production. It is important to reduce weed seed banks during the early phase of crop growth so that young celery plants will not have to compete with weeds later on in the season. The practice of irrigating to germinate weed seedlings followed by applications of contact agrochemicals is very effective for this purpose (CMCC, 2004).

Until today, the major tactics that farmers have employed as components of their system of Integrated Pest Management (IPM) have been the use of clean planting stock, resistant varieties, celery-free periods, irrigation management, and chemical control. Further research programmes are designed to address issues for celery production. The demonstration of clear economic benefits of such low-input IPM strategies to producers is the most effective means to accelerate the adoption of such programmes and create a demand for development of additional low-input IPM for other agro-ecosystems. Therefore, accurate economic information on the benefits of proposed IPM strategies is required for farmers. Creation of partial budgets using accurate economic information provided by farmers can generate persuasive data on net profits resulting from specific control strategies. Thus, implementation can occur rapidly once the barrier of perceived risks is eliminated (Trumble et al., 2000).

However, in recent years, many analyses have been undertaken on agrochemical use in celery production (Burt, 2005; Gianessi and Reigner, 2006; Gianessi and Silvers, 2000; Goodhue et al., 2005; Grumet and Hausbeck, 2002; Koike et al., 1996, 1997, 2006; Reitz et al., 1999;Weintraub et al., 1996). Nevertheless, there is still a need for further study, especially economic analysis by agrochemical class and type.

Recently, the Turkish Ministry of Agriculture and Rural Affairs encouraged IPM in the region. IPM is a systems approach to reduce pest damage to tolerable levels using a variety of techniques such as natural enemies, genetically resistant plants, sound cultural practices, and, when appropriate, agrochemicals. The IPM approach is based on proper pest identification, periodic scouting, and application of pest management practices during the precise stage of the crop's development where no control actions would result in significant economic losses.

The purpose of this study was to determine the amount and types of agrochemicals used for weeds in celery grown in Izmir and to analyse the farm-level economics of their use. In addition, farmers' attitudes towards their use of agrochemicals, their use of IPM practices, and their agrochemical use problems were also determined.

2. Materials and methods

The cost, yield, and price data were analysed to determine the profitability of a typical operation. A group of 24 farmers, selected using a random sampling method from Izmir, Turkey, responded to an intensive survey designed to analyse these factors. Celery plants were grown for the production season of 2005–2006. Plants were transferred into the production area in August 2005. Harvests started in October 2005 and continued until March 2006.

Izmir celery farmers produce more than 45% of the nation's celery. Odemis, Torbali, Menemen, and Bayindir are very important districts for celery production in Izmir, where farmers produce more than 83% of Izmir's celery.

Izmir is situated in the western part of Turkey between 38°15′ N and 27° and 28°30′E and has a Mediterranean climate. The warmest and coldest months in Izmir are July and January, respectively. The annual precipitation is about 550 mm and the average relative humidity is 63%.

In this study, the cost items of celery production were classified into variable costs and fixed costs. The variable costs associated with celery growing were all inputs that directly related to the production of celery and covered labour, fertilizers, agrochemicals, seed, electricity, transport costs. Further variable costs included bank interest on total variable costs. Variable costs were calculated by using current input prices and labour costs. Interest on total variable costs was calculated by charging a simple interest rate of 6% (saving deposits interest rates in US$) on one-half of the total variable costs (the reason for dividing the annual interest into two is that celery production and marketing period were each approximately of 6 months duration).

In this study, fixed costs included administrative costs and land rent. Estimating the annual costs of using machinery, equipment, and other assets is a challenge in cost of production studies. In this study, services such as land preparation were priced to the enterprise as a "bundled" service/task reflecting both machinery and labour components of the service.

Administrative costs have been estimated at 2–7% of total gross production value or 3–7% of total costs (Kiral et al., 1999; Mulayim, 2001). In this study, administrative costs were estimated to be 3% of total variable costs. This method was also applied in previous studies (Engindeniz, 2006; Engindeniz and Engindeniz, 2006). Celery production areas were exempted from land tax and were not