

Agrovoc descriptors: lycopersicon esculentum, tomatoes, varieties, fruit vegetables, plant production, cultivation, data collection, surveys, farm surveys, farmers, rural population, land ownership, ownership, development indicators, postharvest losses, crop management

Agris category code: f01, e20, e51

Assessment of production practices of small scale farm holders of tomato in Bagrote Valley, CKNP region of Gilgit-Baltistan, Pakistan

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Received January 27, 2012; accepted February 23, 2012.
Delo je prispelo 27. januarja 2012, sprejeto 23. februarja 2012.

ABSTRACT

The primary data used for the investigation were obtained through a questionnaire. One hundred and twenty (120) farmers were randomly selected; their education level, area of cultivation, time of planting, intercropping, varieties grown, fertilizer used, time of picking, packing, transportation and processing were looked at. It was found that out of 120 respondents, 52% were literate, and 48% were illiterate. 90% land holders were owners while remaining were tenants. Roma variety (46%) was preferred variety followed by Rio-Grind (38%) and Heirloom variety (16%). In terms of picking time, majority of farmers picked tomatoes in the afternoon (38%) or evenings (34%) and rest picked them in the mornings (28%). All the farmers transported tomatoes to local market either in wooden boxes (76%) or traditional baskets (24%). Majority of the farmers responded positively to drying tomato, but (27%) were unaware of processing procedures. Over all loss of tomato crop to fungal and viral diseases was estimated to be 24%.

Key words: Tomato, production practices, post-harvest losses, assessment

IZVLEČEK

OČENJEVANJE PRIDELOVANJA PARADIŽNIKA NA MAJHNH KMETIJAH V DOLINI BAGROTE, CKNP OBMOČJE GILGIT-BALTISTANA, PAKISTAN

Podatki za raziskavo so bili pridobljeni z anketnim vprašalnikom. Naključno je bilo izbrano 120 kmetov glede na njihovo izobrazbo, velikost obdelovalne površine, čas sajenja, uporabo medposevkov, sorte paradižnika, uporabo gnojil, čas pobiranja, način pakiranja, transporta na trg in predelave. Raziskava je pokazala, da je bilo 52 % pridelovalcev pismenih in 48 % nepismenih. 90 % pridelovalcev so bili lastniki zemljišč, ostali so bili najemniki. Najbolj priljubljena sorta je bila 'Roma' (46%), sledili sta ji sorti 'Rio-Grind' (38 %) in 'Heirloom' (16%). Kmetje so najbolj pogosto pobirali paradižnike ob popoldnevih (38%) ali zvečer (34%), ostali zjutraj (28%). Večina kmetov je transportirala paradižnik na lokalne trge v lesenih zabojih (76%) ali v tradicionalnih košarah (24%). Večina pridelovalcev se je odzvala pozitivno na možnost sušenja paradižnikov, le manjši del (27%) ni poznal tega postopka predelave. Celokupna izguba pridelka zaradi glivnih in virusnih okužb je bila ocenjena na 24%.

Ključne besede: paradižnik, tehnologija pridelave, izguba pridelka po obiranju, ovrednotenje

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1 INTRODUCTION

Tomato (*Lycopersicon esculentum*) is a staple fruit vegetable. Fresh fruits and vegetables are very important source of vitamins and minerals which are essential for human health.

Tomato is one of the most important vegetables in the world. It is considered as an important cash and industrial crop in many parts of the world (Babalola *et al.*, 2010).

Tomatoes are grown as fresh market and as processing tomatoes. They are important for food industry as they serve as raw material for production of value added products (Soe, 2003). The domestic consumption and demand for tomato is growing due to increase in population. It is very important vegetable with substantial nutritional value. Moreover it is available at low price as compared to other vegetables. It is consumed in every home in different modes, such as vegetable, salad, ketchup, chatni and it is part of every delicious cuisine. Due to wide seasonal variations in Pakistan tomato is available throughout the year.

Pakistan produces two crops annually first in spring and second in autumn. However, in southern Pakistan tomato can be grown throughout the year. Pakistan produced 560,700 tones tomatoes in 2008-9. Production/hectare was 10.50 tones. During 2008-09 total area under cultivation were 53,400 hectares (Agric Stat, 2008-09). While Gilgit-Baltistan produced 6,455 metric tons tomatoes. Of which 3194 MT were consumed, 2293 MT were marketed, and 968 M.T were wasted. While, in Gilgit-Baltistan tomatoes were cultivated on 805 hectare (Agric Stat, 2009).

Despite the remarkable progress made in increasing world food production at the global level, approximately half of the population in the third world does not have access to adequate food supplies. There are many reasons for this. For instance food losses to pests, diseases, lack of awareness of modern production practices, seed selection and post harvest problems. Evidence suggests that these losses tend to be highest in countries where the need for food is greatest (FAO, 1989; Oyewole and Oloko, 2006; Babalola *et al.*, 2008).

Optimum production of tomato requires intensive management practices that conserve and manage soil nutrients needed for maintaining soil fertility and water quality and for sustaining tomato production (Yafa *et al.*, 2000).

It is also common knowledge that production of tomatoes is declining due to some bacterial, fungal diseases and pest attacks. Furthermore, lack of resistant varieties and poor marketing add to farmer's woes. Therefore, this crop needs special attention of extension workers, researchers, policy makers and growers to identify the constraints, improve production methods and suggest remedial measures to enhance tomato production in Pakistan. This study was conducted to achieve following objectives.

To review the production practices followed by the tomato producers in Bagrote valley.

To propose new and innovative methods of replacing existing traditional production practices.

2 MATERIALS AND METHODS

2.1 Study area

Bagrote valley is situated in the North-West of Gilgit at two hours drive from the city. The valley has fertile lands and is famous for the production of seasonal crops, like wheat, potato, maize and vegetables. Bagrote valley consists of eight villages. Irrigation system of valley consists of water canals. This valley is famous for tomato production but in last few years production has steadily declined, so current study was conducted to assess production practices of small scale Tomato growers.

2.2 Data collection

This study was based on primary data collected from tomato producers during Kharif 2010-11. Sample survey was carried out and personal interviews were held to collect the information. Before launching, the survey

questionnaire was pre tested and was improved accordingly. Key informant technique was also followed to get authenticated information.

2.3 Sample size

The survey included 120 randomly selected tomato growers. There are many estimation techniques. Frequency tables are very useful in knowing the trend related to a particular variable. The same technique was followed in analyzing results of this study. Percentage method was used to analyze farmers' responses related to production practices and post-harvest losses. The analysis was carried out in relation to percentage analysis on tomato; including education level, cultivation time, fertilizer use, intercropping, picking time, varieties grown, mode of transportation, processing, sale point and disease prevalence.

3 RESULTS AND DISCUSSION

3.1 Education level of farmers and their tenant status

Literacy is one of the important characteristics of farmers that greatly influences the adoption of new technology. Data with respect to the literacy rate of sampled farmers were collected on the basis of their schooling years. Those who had completed school education were categorized as literate and those who had no formal school education were deemed as

illiterate. It was observed that out of 120 farmers, 52% were literate while remaining 48% growers were illiterate. Tenancy is an agreement between land owners and farmers under which land owners lease out their land to tenants who work the land and pay agreed rent or hand over agreed share of crop to land owners (Amanullah, 1999). From our studies it was observed that 90% tomato growers were owners. Whereas, remaining 10% were tenants (Table 1).

Table1: Number of farmers classified by their education level and tenure status

Education Level	Frequency	Percentage
Literate	62	52
Illiterate	58	48
Total	120	100
Tenure Status	Owner	Tenants
	90%	10%

3.2 Time of cultivation & operational area held by the farmers

Majority of the farmers planted tomatoes in August. However, some planted them in march as well (Table 2). Operational holding of farmers plays a significant role in the adoption of new technology. A number of researchers reported that there is an inverse relationship between farm size and productivity (Maureithi

et al., 1991 and Kapronczai and Tomka, 1991). While, other studies do not support this contention that farm size affects the productivity and inputs (Thakur *et al.*, 1990). Data regarding operational land holdings showed that 71% of farmers had tomato patches measuring from 1-10 Marlas (one marla = 50 sq. yards), 14% farmers had fields up to 10-20 Marlas and 15% had fields upto 20-30 Marlas.

Table 2: Numbers of farmers classified by time of cultivation of tomato

Time of Cultivation	Frequency	Percentage
March	20	17
August	100	83
Total	120	100

3.3 Intercropping in tomato crop

Our survey showed that majority of the farmers (54%) practiced intercropping in order to minimize the risks and maximize returns.

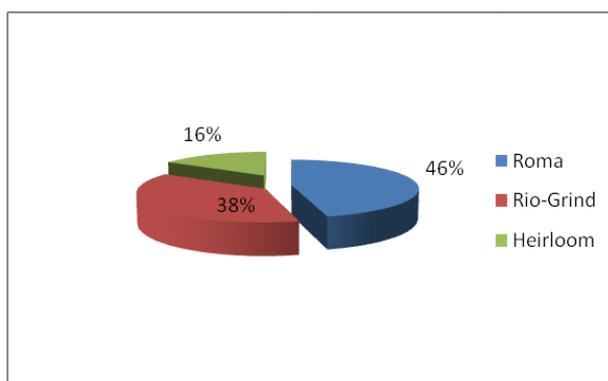
28% farmers cultivated leafy vegetables, 12% Beans, 13% Cabbage, 3% Radish and 4% Corundum crops, while the remaining 46% did not practice intercropping in their fields.

3.4 Tomato varieties grown by the farmers

Our study showed that majority of the farmers used Roma variety (46%) followed by Rio-Grind (38%) and

Heirloom (16%). Farmers prefer Roma and Rio-Grind tomato varieties because of their good shape, flesh and weight. These tomatoes are easy to market and farmers can get better returns. Heirloom variety was grown for home consumption and processing (Fig. 1).

Figure 1: Percentage of different varieties grown in Bagrote valley

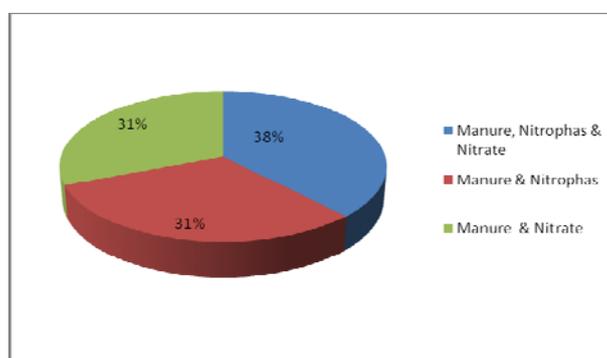


3.5 Tomato varieties

Balanced use of fertilizers in proper quantities and their timely application is inevitable in getting a good yield. Research has shown that growing same crops on the same piece of land for years depletes soil nutrients and therefore, for raising good crop it becomes imperative to replenish the soil fertility with the application of organic and inorganic fertilizers. Commercial fertilizers are the major source of readily available nutrients to enhance crop production and achieve food security. The application of fertilizers in balanced ratio not only guarantees a good crop but also maintains

the natural fertility of the soil. Gurmani *et al.*, 2003 reported that proper supply of nitrogen to crop is associated with the enhancement of photosynthetic activity, vigorous growth and dark green colour of plant leaves. Being a vital part of the building blocks of genes and chromosomes, phosphorus controls all the living processes in plants. It is not only essential for cell division but also for energy transport system in all cells (Saleem, 2003). It was observed in the present study that out of 120 farmers 38% farmers used manure (cow dung) Nitrophas, and Nitrate, 31% used manure & Nitrophas. While 31% used manure & Nitrate (Fig. 2) only.

Figure 2: Number of farmers classified by use of fertilizers in tomato field



3.6 Picking time of tomatoes

The time of picking is considered most important factor in post - harvest losses. Our study indicated that picking time is determined by the commitments of farmers with the transporters for short and long distance transportation. It was observed that the farmers, who transported their produce to the

local and nearby markets, generally pick tomato early in the morning (28%). But most farmers, pick tomato in morning for drying as well. While the farmers who transport their produce to distant markets, pick their tomato in afternoon (38%) and evening time (34%) in order to make the produce ready for transportation and available for sale in the wholesale markets.

Table 3: Numbers of farmers classified by time of tomato picking

Time of Picking	Frequency	Percentage
Morning	33	28
Afternoon	46	38
Evening	41	34
Total	120	100

3.7 Packaging material used for tomato crop

Packing of mechanically injured or fungus infested fruit increases probability of considerable deterioration (De Lucia and Assennato, 1994). Efforts were also made to develop a relationship between fungal infection and distance from the market.

Remove bruised and damaged fruits and pack fruits with similar maturity stage in one container. Separate ripe fruits since these produced ethylene that could hasten the

ripening process of unripe fruits. There are different modes of packaging. Generally, container-packing is considered ideal for packing fruits or vegetables because these are easy to handle, provide good protection from mechanical damage, have adequate ventilation and convenient for merchandising. For local markets tomatoes can be packed in wooden boxes or other traditional crates assuring careful handling. From the present study it was observed that for local markets cardboard boxes or wooden crates (76%) 70 to 80 kg and Traditional baskets (24%) with 30-35 kg capacity were used (Table 4).

Table 4: Numbers of farmers classified by use of packaging material of tomato

Material Used	Frequency	Percentage
Wooden boxes	91	76
Traditional Baskets	29	24
Total	120	100

3.8 Sale points

It was found that all the tomato growers brought produce to local market for sale and

none of the growers transported their produce to distant markets.

Table 5: Numbers of farmers classified by sale points for tomato produce

Sale Points	Frequency	Percentage
Local Market	120	100
Outside	0	0
Total	120	100

3.9 Mode of transportation

Most tomato growers (86%) transported their product to markets by jeeps while the remaining (14%) farmers used other sources to transport their produce. During transportation fruit passes through ripening, which is a complex phenomenon. It involves maturation, color change, production of ethylene, tissue

softening, and change in respiration rate, fruit membrane thickness and permeability. During transportation the produce should be immobilized by proper packaging and stacking, to avoid excessive movement or vibration. Vibration and impact during transportation (Table 6) may cause severe bruising or other types of mechanical injury to the food (Gregor, 1987).

Table 6: Numbers of farmers classified by mode of tomato transportation

Mode of Transportation	Frequency	Percentage
Jeeps	103	86
Others	17	14
Total	120	100

3.10 Knowledge of tomato processing

Large quantities of tomato fruits are harvested each season, but post - harvest processing and preservation techniques are ineffective. Therefore, fruits spoil very early because of lack of appropriate system of preservation and processing (Francois, 1995). To reduce the post-harvest losses and over supply to the markets, it is essential that the surplus and

over ripe produce be separated and processed. In order to know the farmers' knowledge of processing, tomato growers were asked whether they knew what can be produced from tomato crop. Of the total respondents, 27% responded negatively and the remaining 73%, responded positively (Table 7). They were using drying techniques and hence were aware of processing.

Table 7: Numbers of farmers classified by tomato processing techniques

What can be produced	Frequency	Percentage
Drying	88	73
Others	0	0
Nothing	32	27
Total	120	100

3.11 Post - harvest losses in tomato crop

The post harvest loss of tomato crop in Bagrote valley is 24% and the remaining is available with the growers for consumption and marketing.

(Raja and Khokhar, 1993) stated that postharvest losses in fruits and vegetables range from 25-40% or even greater (Iqbal, 1996). The post harvest losses of tomato crop in Peshawar valley was 20% (Manzoor *et al.*, 2006). Seasonal post harvest losses of fruits and vegetables are high in the tropics due to hot environmental conditions and moisture levels (MAEP, 1999).

The deterioration of fruits and vegetables starts right after their harvest, if not properly harvested. Generally accepted methods for

evaluating post - harvest losses of fresh produce do not exist. In the appraisal of an existing marketing operation, the accurate evaluation of losses is a problem. It may be conjectured that losses are huge, but there may be no figures to support this view (FAO, 2002).

3.12 Storage

During the survey it was observed that most of the farmers picked their crop in afternoon and transported their produce to local markets in wooden Crates using jeeps as a mode of transportation. The estimated post harvest losses of tomato crop in Bagrote valley were 24% of the total production. These losses may occur during picking, handling transportation, etc.

Due to poor storage conditions resistance of fruit and vegetables to natural disease usually declines, leading to infection by pathogens (Tefera *et al.*, 2007). Many horticultural crops have a relatively short harvesting season. Storage is needed to extend the marketing period. Air-cooled common storage houses are often used in this regard. To delay ripening in tomato temperature should be greater than 26-27 °C as they are harvested at different stages and stored. Although fully ripened tomatoes may be held at 2-5 °C before consumption for short time (Maul *et al.*, 2000) but the mature green tomatoes should not be placed at temperature below 12 °C as it causes chilling injury which adversely affects quality and ripening (Saltveit, 2001). There is significant loss of weight and firmness in tomatoes during storage due to the effect of temperatures (Van Dijk *et al.*, 2006) and there is relationship between the harvest and firmness changes in tomato. Different techniques are employed to improve the shelf life of fresh commodities. One of the techniques to improve shelf life of tomatoes is edible coatings (Baldwin *et al.*,

1995). These edible coating can be used to preserve vegetables by providing barrier to moisture, oxygen and carbon dioxide and also improve its handling properties and contribute to the production of volatile aroma (Oliva *et al.*, 2005). Absence of proper storage and marketing facilities, farmer is forced to sell their products at throw away prices. Sometimes farmers do not even get the two ways transportation costs back, so they would rather dump their produce near the market area than taking them back to home.

3.13 Tomato field diseases and insect damage

During field visits three fungal, two bacterial and two insect pests causing damage were observed (Table 8). A study conducted in Sindh during 2004 revealed that various fungal, bacterial and viral diseases attack tomato crop. It was also reported that *Rhizoctonia solani* was isolated with highest frequency i.e. 60.0% (Rajput, 2004).

Table 8: Field diseases of tomato crop

Early blight	<i>Phytophthora infestans</i>	Fungal
Late Blight	<i>Alternaria solani</i>	Fungal
Gray leaf spot	<i>Stemphylium solani</i>	Fungal
Fusarium wilt	Fusarium oxysporium	Fungal
Bacterial spot	<i>Xanthomonas campestris</i>	Bacteria

4 CONCLUSION

Based on the results and observations made during the survey, it seems that the current farming system of tomatoes, in Bagrote valley of CKNP region is inadequate. The farmers lack fundamental knowledge about production practices, disease and post harvest handling practices.

Therefore the following recommendations are made:

- Farmers must be provided extension lectures on new and innovative production methods.

- Young and educated persons must be encouraged to take to farming and they must be provided financial incentives.
- Farmers should be educated to adopt modern technologies for tomato production and they must be assured that it will work to their advantage.
- Farmers must be helped with farm infra structures and provided with post-harvest farm facilities in order to avoid post-harvest losses.

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