

Apple Pollination Problems in Balochistan, Pakistan

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ABSTRACT

Results indicated that there is a trend of gradual decline in overall apple yield at provincial level. Majority of farmers (72%) had no knowledge of using a variety as pollinizer in district Kalat. In Killa Saifullah, 60% were using local variety as pollinizer and Gaja was favourite pollinizer in Loralai. Farmers of Mastung, Pishin and Quetta were also not aware of using any pollinizer variety. Overall 49% respondents were regularly using pesticides. Out of total, 79% respondents perceived that the insect population was decreasing. Eighty seven per cent of respondents did observe various kinds of insects foraging on apple flowers.

Key Words: Apple; Pollination; Balochistan; Pakistan

INTRODUCTION

Nearly 80% of total apple production of Pakistan is contributed by Balochistan and is mainly produced in Kalat, Killa Saifullah, Loralai, Mastung, Pishin, Quetta and Ziarat districts. The area under this fruit has explicitly increased more than five times during the period from 1980-81 to 1996-97 (Anonymous, 1999). Overtime data in Table I reveals that apple production has increased mainly due to visible increase in apple area in Balochistan. At present, it is unfortunate to observe that yield of apple is far below the potential. Gap between the actual and potential yields of apple orchards could be reduced by modern agronomic practices, higher inputs as well as proper pollination management. Insects play a vital role in pollination of various crops particularly in apple orchards. Indiscriminate use of pesticides in modern agriculture has disturbed the ecological inter-relationship by massive killing of farmer friendly insects along with detrimental insects (Verma & Partap, 1993). In Pakistan, one symptom of the shortage of friendly insects is alternate years of fruit bearing in most of apple orchards in Balochistan most probably due to lack of pollinating agents and another indication is overtime decline in fruit yields in North West Frontier Province (NWFP) of Pakistan (Partap & Partap, 1997). This study visualizes farmers' perception about the extent of this problem of vital importance causing a wide gap between the actual and potential yields. The primary objective of this study has been to provide farm level empirical evidence of losses caused by this missing dimension of apple orchard management in Balochistan.

MATERIALS AND METHODS

The National Aridland Development and Research Institute (NADRI), Ministry of Food, Agriculture and Livestock (MINFAL), Islamabad and the International

Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal in collaboration with Arid Zone Research Centre (AZRC), Brewery Road, Quetta and Department of Agricultural Extension, Quetta conducted a formal survey in the major apple growing districts of Balochistan. Main purpose of the survey was to assess the degree of awareness among apple growers about enhancing apple productivity through managing crop pollination. For this purpose, 76 apple growers from seven apple-growing districts were interviewed. Distribution of sample apple growers is presented in Table II.

RESULTS AND DISCUSSION

Apples are mainly grown in areas with an altitude of 1200 m and above, whereas the prime quality apple are coming from highlands with an altitude above 2000 m due to greater number of chilling hours.

Characteristics of sample apple growers and their orchards. Average size of holding and area under apple orchards is presented in Table III. Mean holding size and area under apple orchards on sample farms was respectively estimated as 18.17 and 9.29 ha. Apple orchards constituted more or less 57% of total farm size of sample farmers. Average farm size was relatively larger in district Killa Saifullah followed by districts of Mastung and Ziarat. Among sample districts maximum percentage of total holding size under apple orchards was in district Loralai (84%) followed by district Kalat (78%) and district Pishin (77%). Average density in local orchards is approximately 170 to 240 trees ha⁻¹ and as long as trees are not bearing, intercropping with vegetables and alfalfa is common. Generally farmers do not appreciate pruning of orchard trees.

Apple yield. Table I indicates that there is a trend of gradual decline in overall apple yield at provincial level. Sample farmers opinion about declining apple yield is indicated in Table IV. Apple growers in sample districts

Table I. Area and production of apple in Balochistan

| Year | Area (000 ha) | Production (000 t) | Average yield (t/ha) |
|---------|---------------|--------------------|----------------------|
| 1969-70 | 2.7 | 19.1 | 7.15 |
| 1973-74 | 4.0 | 29.2 | 7.24 |
| 1980-81 | 6.7 | 55.8 | 8.33 |
| 1981-82 | 7.0 | 59.6 | 8.51 |
| 1982-83 | 7.6 | 69.3 | 9.12 |
| 1983-84 | 8.4 | 73.0 | 8.69 |
| 1984-85 | 9.1 | 79.4 | 8.73 |
| 1985-86 | 9.7 | 85.1 | 8.77 |
| 1986-87 | 10.7 | 91.7 | 8.57 |
| 1987-88 | 11.2 | 105.3 | 9.40 |
| 1988-89 | 13.8 | 110.7 | 8.02 |
| 1989-90 | 14.1 | 124.7 | 8.84 |
| 1990-91 | 14.3 | 136.5 | 9.55 |
| 1991-92 | 19.9 | 211.3 | 10.62 |
| 1992-93 | 23.3 | 253.4 | 10.88 |
| 1993-94 | 31.2 | 356.2 | 11.42 |
| 1994-95 | 32.1 | 446.1 | 13.90 |
| 1995-96 | 33.4 | 466 | 13.95 |
| 1996-97 | 35.0 | 480.2 | 13.72 |
| 1997-98 | 35.9 | 482.6 | 13.44 |

(Government of Pakistan, 1999)

felt that numerous factors were causing yield decline. Majority considered weather changes coupled with pest attack (54%) and weather changes alone (53%) were mainly responsible for decrease in apple productivity. Little less than 1/3rd of respondents believed that absence of beekeepers would have caused decline due inadequate pollination.

Apple Varieties in Balochistan. Recently developed orchards are dominated by 'red and yellow delicious' varieties, whereas older varieties such as Kashmiri and Amri have become less popular. These local rootstocks begin bearing after 7 to 8 years and peak yields are obtained at the age of 15 to 18 years. Introduction of semi-dwarf rootstock has had a mixed response despite various advantages such as smaller trees suitable for easy spraying, pruning and picking as well as early bearing by 3 to 4 years.

Red delicious and Golden delicious are popular varieties through out sample districts. Gaja is another important apple variety for growers. Other reported are Amri, Kashmiri, Mashadi and traditional. Farmers opinion was invited regarding their perception about use of any specific variety as pollinizer in their orchards (Table V). Majority of orchard owners (i.e. 72%) had no knowledge of using

Table II. Distributions of sample apple growers in Balochistan

| Districts | Number of farmers | Percent |
|-----------------|-------------------|---------|
| Kalat | 8 | 10.5 |
| Killa Saifullah | 10 | 13.15 |
| Loralai | 6 | 7.89 |
| Mastung | 16 | 21.10 |
| Pishin | 13 | 17.10 |
| Quetta | 14 | 18.42 |
| Ziarat | 9 | 11.84 |
| Total | 76 | 100 |

Table III. Mean size of holding and area under apple orchards of sample farmers

| District | | Mean size of holding (ha) | Area under apple (ha) | % Apple area |
|-----------------|---------|---------------------------|-----------------------|--------------|
| Kalat | Average | 9.55 | 4.95 | 78 |
| | STD | 7.51 | 2.55 | |
| | MIN | 0 | 0.404 | |
| Killa Saifullah | Average | 28.34 | 8.097 | 44 |
| | STD | 27.69 | 12.10 | |
| | MIN | 30.012 | 14.52 | |
| Loralai | Average | 10.12 | 0 | 84 |
| | STD | 80.97 | 30.36 | |
| | MIN | 9.63 | 8.097 | |
| Mastung | Average | 8.31 | 2.862 | 42 |
| | STD | 0 | 6.07 | |
| | MIN | 20.24 | 10.12 | |
| Pishin | Average | 25.506 | 10.823 | 77 |
| | STD | 28.717 | 8.26 | |
| | MIN | 0 | 0.80 | |
| Quetta | Average | 121.457 | 24.29 | 52 |
| | STD | 15.35 | 11.99 | |
| | MIN | 9.65 | 5.99 | |
| Ziarat | Average | 4.048 | 2.02 | 24 |
| | STD | 40.485 | 20.24 | |
| | MIN | 9.55 | 4.95 | |
| Ziarat | Average | 7.51 | 2.55 | 24 |
| | STD | 0 | 0.404 | |
| | MIN | 28.34 | 8.097 | |
| Ziarat | Average | 25.42 | 6.14 | 24 |
| | STD | 53.68 | 10.89 | |
| | MIN | 0.809 | 0.80 | |
| Ziarat | Average | 121.45 | 28.34 | 24 |
| | STD | | | |
| | MIN | | | |

(Survey, 2000)

a variety as pollinizer in district Kalat. In Killa Saifullah, 60% of the respondents plant local variety as pollinizer. Gaja is favourite pollinizer variety of Loralai farmers (60%). Similar to district Kalat, most of the apple growers in the districts of Mastung, Pishin and Quetta were not aware of planting pollinizer variety in their orchards. It may be concluded that majority of the farmers in Balochistan do not plan for planting any specific apple variety as pollinizer.

Pesticide use in apple orchards. Overall 49% of the respondents were regularly using pesticides in these apple orchards. Most of the respondents in district Loralai (83%) reported regular use of pesticides, whereas a minimum use of pesticides was reported in district Mastung (31% of sample farmers). On average, the sample farmers conduct five sprays/season with a range of 2 to 7 sprays per season. All respondents of all districts sprayed their orchards at fruit set stage except the farmers of district Pishin who reported pesticide spraying during flowering.

Apple pollination in apple orchards. Overall 95% of the interviewees had knowledge of apple pollination process in their orchards (Table VI) for the last 14 years. They had gained this awareness through their interaction with beekeepers (37%), extension workers of the Department of Agriculture Extension, Balochistan (36%) and other sources including literature (27%).

Table IV. Reasons for overtime decline in per hectare apple yield in the study area

| District | Weather change and disease (#) | Weather change (#) | Trees old and weak (#) | Weather change and insect attack (#) | Absence of beekeeper (#) |
|-----------------|--------------------------------|--------------------|------------------------|--------------------------------------|--------------------------|
| Kalat | 2 | 4 | - | 5 | 4 |
| Killa Saifullah | 4 | 3 | - | 6 | 2 |
| Loralai | 3 | 3 | - | 5 | 2 |
| Mastung | 2 | 7 | 7 | 10 | 8 |
| Pishin | - | 12 | - | 12 | 4 |
| Quetta | 2 | 10 | - | 2 | 1 |
| Ziarat | 2 | 1 | 1 | 1 | 1 |
| All | 15 | 40 | 8 | 41 | 22 |
| Percentage | 20 | 53 | 11 | 54 | 29 |

= Number of observation; (Survey, 2000)

Table V. Main as well as pollinizer apple varieties in Balochistan

| District | Main Variety | Pollinizer Variety | Percent |
|-----------------|---|------------------------------------|---------|
| Kalat | Traditional, Red delicious, Golden delicious, Gaja | Mixed | 28 |
| | | Don't know | 72 |
| Killa Saifullah | Kashmiri, Red delicious, Golden delicious, Gaja, Amri | Red delicious and Golden delicious | 40 |
| | | Local variety | 60 |
| Loralai | Gaja, Red delicious | Gaja | 60 |
| | | Golden delicious | 20 |
| Mastung | Traditional, Red delicious, Golden delicious, Amri, Mashadi | Mashadi | 20 |
| | | Red delicious | 26 |
| Pishin | Amri, Red delicious, Golden delicious | No answer | 74 |
| | | Red delicious and Golden delicious | 7 |
| Quetta | Amri, Red delicious, Mixed, Gaja, Mashadi, Golden delicious | No answer | 93 |
| | | Red delicious | 24 |
| Ziarat | Mixed, Red delicious, Golden delicious, Traditional, Gaja | Golden delicious | 7 |
| | | Don't know | 69 |
| | | Mixed | 68 |
| | | Gaja | 16 |
| | | Don't know | 16 |

(Survey, 2000)

Apple pollination in apple orchards. Overall 95% of the interviewees had knowledge of apple pollination process in their orchards (Table VI) for the last 14 years. They had gained this awareness through their interaction with beekeepers (37%), extension workers of the Department of Agriculture Extension, Balochistan (36%) and other sources including literature (27%).

Majority of the respondents (57%) believed that wind and natural insects were pollinating agents in their orchards. However, 33% of them regarded honeybees and butterflies as pollinating agent, whereas 10% of them did not know about pollinating agents.

Farmers awareness about pollinating agents. Pollen of deciduous fruit trees especially apple are rather gummy and are mostly transferred by insects. During the field survey, farmers' perception on this aspect was gathered. Ninety seven per cent of the respondents did observe various kinds of insects foraging on apple flowers in their orchards. About 39% of the interviewees reported honeybees on apple flowers. These honeybees were most probably wild. Majority of the farmers (87%) had knowledge of butterflies, wasp etc. visiting their apple orchards.

Majority of survey respondents (79%) perceived that the insect population was decreasing whereas few of them (16%) maintained that there was no change in it. They suspected multiple factors responsible for decline in natural

insect population (Table VII). Most of them considered indiscriminate use of pesticides in orchards as major cause of decrease in insect population, whereas quite a few of them did think climatic changes also responsible of it. Overall, more than 50% of the interviewees reported wild honeybee colonies in forests, and their existence in forests was confirmed in all study districts.

Honeybees for pollination management in apple orchards. Farmers viewpoint about keeping honeybee at apple farm, honeybee types and the degree of commercialization was also solicited during the survey. A very small proportion of sample farmers gave affirmative reply about keeping bees at the farm and all of them preferred native bees over European breeds. Majority of farmers replied negatively on the question of keeping honeybees for commercial purpose (Table VIII).

Migratory honeybee keepers from other provinces do visit highlands of Balochistan and their camps are mostly seen in the Juniper forests of Ziarat during late summer. Meanwhile they would benefit from the blossom of a plant species (*Perwaskis artiplicifolia*) and with the onset of winter, they would migrate back to their origin. Since their migratory season do not match with the season of apple flowering, it may be concluded that these migratory colonies do not play any role in improving apple pollination in Balochistan.

Table VI. Farmer's perception of apple pollination and their source of awareness

| District | Knowledge about apple pollination (#) | Don't know (#) | History of pollination awareness (Years) | Source of awareness | | | |
|-----------------|---------------------------------------|----------------|--|---------------------|---------------|-------|--------|
| | | | | Beekeeper | Govt. officer | Books | Others |
| Kalat | 8 | - | 10 | 3 | 4 | - | 1 |
| Killa Saifullah | 10 | - | 10 | 1 | 2 | - | 7 |
| Loralai | 6 | - | 12 | 1 | 4 | 1 | - |
| Mastung | 16 | - | 12 | 6 | 5 | 1 | 4 |
| Pishin | 12 | 1 | 10 | 7 | 4 | - | 1 |
| Quetta | 14 | - | 12 | 5 | 4 | - | 5 |
| Ziarat | 6 | 3 | 18 | 5 | 4 | - | - |
| All | 72 | 4 | 14 | 28 | 27 | 2 | 18 |
| Percentage | 95 | 5 | | 37 | 36 | 3 | 24 |

= Number of observation ; (Survey, 2000)

Table VII. Farmers perceptions about overtime changes in insect population on apple flowers

| District | Reasons | | | Decreasing insect population | | |
|-----------------|----------------|----------------|----------|---------------------------------|------------------------------|---------------------------|
| | Decreasing (#) | Increasing (#) | Same (#) | Killed by use of pesticides (#) | Increased apple orchards (#) | Due to climate change (#) |
| Kalat | 8 | - | - | 8 | 5 | 4 |
| Killa Saifullah | 8 | - | 2 | 5 | 3 | 3 |
| Loralai | 4 | - | 2 | 6 | 2 | - |
| Mastung | 14 | - | 2 | 16 | 1 | 16 |
| Pishin | 9 | 2 | 2 | 11 | 1 | 6 |
| Quetta | 12 | - | 2 | 14 | 1 | 13 |
| Ziarat | 5 | 2 | 2 | 5 | 1 | 1 |
| All | 60 | 4 | 12 | 65 | 14 | 43 |
| Percentage | 79 | 5 | 16 | 86 | 18 | 57 |

= Number of observation; (Survey, 2000)

Table VIII. Farmers' perceptions about honeybee

| Locations | Honeybee keeping | | If yes types | | Commercial bee keeping (if yes) | | |
|-----------------|------------------|--------|--------------|--------------|---------------------------------|--------|-----------------------|
| | Yes (#) | No (#) | Native (%) | European (%) | Yes (#) | No (#) | Local Migratory place |
| Kalat | - | 8 | - | - | - | 8 | -- |
| Killa Saifullah | - | 13 | - | - | - | 13 | -- |
| Loralai | 1 | 6 | 30 | - | 1 | 6 | - From Ziarat |
| Mastung | - | 16 | - | - | - | 16 | -- |
| Pishin | - | 13 | 1 | - | - | 13 | - From Ziarat |
| Quetta | 1 | 8 | 8 | - | 1 | 8 | - From Ziarat |
| Ziarat | 1 | 9 | 10 | - | 1 | 9 | -- |
| All | 3 | 73 | 49 | - | 3 | 73 | -- |
| Percentage | 4 | 96 | 64 | - | 4 | 96 | -- |

(Survey, 2000)

CONCLUSIONS

The survey results revealed that most of the apple producers had no knowledge about pollinizers and do not plan in this regard at the time of plantation. It may be a missing dimension in apple orchards of Balochistan.

- Farmers' perceptions and the argument of most profitable combination of varieties for improving productivity demands urgently a study of determining optimal feasible combination of varieties in Balochistan.
- There is an urgent need for integration of cultural and biological production practices with the use of strong honeybee colonies for biological cross pollination i.e. managed apple pollination.
- Indiscriminate use of pesticides might significantly had attributed to declining trends of friendly insects responsible

for apple pollination and causing lower apple productivity. It needs to be verified on scientific grounds.

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