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Research Paper

Comparative analysis of pesticide use for apple production in North-western Himalayan region

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ABSTRACT

Given to low adoption of recommended practices by farmers, indiscriminate use of pesticides has emerged as a challenge the apple industry faces at present. To understand the level of adoption of the recommended pesticide spray schedule and the level of pesticide use in Kashmir Valley, a survey of 200 respondents from two blocks each from four districts of South Kashmir including Kulgam, Pulwama, Shopian, and Anantnag was conducted in 2021 and 2022. Primary data was collected in the form of a questionnaire keeping objectives into consideration. The study revealed that only 1/4th of respondents (25.9%) adopted >80% of the spray schedule. 27.84, 25.36, and 20.89 percent of respondents adopted 60-80%, 40-60%, and < 40% of the spray schedule, receptively. Farmers of district Pulwama used maximum pesticide sprays (17.8) while as Anantnag growers sprayed minimum pesticides (14.2). Pesticide costs during the apple growing season were maximum (Rs.109870/ha) in Pulwama and minimum in district Kulgam (Rs.97360/ha). Similarly, pesticide productivity in terms of pesticide cost per kg of apple fruit varied and ranged between Rs.7.07/kg in district Shopian to Rs.8.99/kg in Anantnag.

Key words: Apple, hills, pesticide, survey

Given the exquisite flavor and numerous health benefits, the cultivation of apples has expanded across the globe (Boyer and Liu, 2004). Kashmir Valley situated in the Northwestern Himalayas is well known worldwide for its apple and the apple industry contributes around 8000 crore to the GDP of Jammu & Kashmir (Wani *et al*., 2021). It provides a major source of income and employment in Kashmir Valley, particularly in the Southern part of the valley (Bhat and Choure, 2014). Given these reasons, this sector occupies an important position in the farming system of Jammu & Kashmir and has assumed great importance during the last few decades (Reshi *et al*., 2010). In recent years, a huge portion of land under crops has been converted to apple for being more remunerative than conventional rice and maize-based cropping systems (Mubarak *et al*., 2023). Apple industry in the state has emerged as an important sector for diversification towards horticulture and has established its credibility in substantially increasing farm income and generating employment in the union territory. The most commonly cultivated varieties in the valley belong to a Red Delicious group and new varieties are being explored under area expansion schemes on high-density apples. No doubt the pesticides coupled with other input technologies have enabled the apple farmers of the Union

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Territory to enhance apple productivity during the last three decades however indiscriminate use of pesticides on the other hand has economic, environmental, and health implications since more than 90% of pesticides are used in apple production system (Baba *et al*., 2017). Pesticides contribute a major portion of production costs in the apple industry (Wani *et al*., 2021) and the pesticide market of the UT of Jammu & Kashmir is estimated at around 400 million (Baba *et al*., 2017). The calculated shares of the Multinational companies and National companies were 33.6 percent and 52.3 percent, respectively (Naqash *et al*., 2019). India is the largest producer of pesticides in Asia and in usage it ranks 12th in the world (Hundal *et al*., 2006; Naqash *et al*., 2019). Fungicides alone accounted for 71.1 percent of total pesticide sales in the state followed by insecticides (15.4%) and acaricides (7.7%) (Baba *et al*., 2017). The pesticides applied on apples together constituted about 83 percent of the total value of agrochemicals utilized in the state (Mir *et al.*, 2017). This makes it important to understand the level of pesticide use in the Valley and suggest measures to reduce indiscriminate pesticide use for the sake of farm economics as well as environmental safety. In this regard, it is also important to know the level of adoption of the spray schedule issued by the state agricultural university SKUAST-Kashmir. Against this backdrop, a study was conducted in south Kashmir which is considered the most pesticide-consuming part of the valley.

MATERIALS AND METHODS

The study envisaged the primary data about pesticide use in apples in the Kashmir valley. The data was collected extensively from eight blocks of South Kashmir, two blocks each from Anantnag, Kulgam, Shopian, and Pulwama districts by using a multi-stage stratified sampling technique. A total of 200 respondents covering rationally each block from various studied districts were selected for the study during 2021 and 2022 and the details of the study area are given in Table 1 & Fig 1.

Various aspects including crop productivity and the economic of pesticide usage were considered and data were collected using well-defined questionnaires. The number of pesticides, their formulation, trade name, application stage, dosage along with precautions while spraying in terms of following SOPs and's and Don'ts while pesticide spray were different determinants for calculating the level of adoption (>80%, 60-80%, 40-60% and <40%) of recommended schedule. The total cost of pesticides was calculated based on the market price during the study years. Apple productivity data was collected from the respondents during the study years to figure out the true picture of pesticide cost on per kg apple produce. The map of the study location was generated using QGIS 3.32 Lima software.

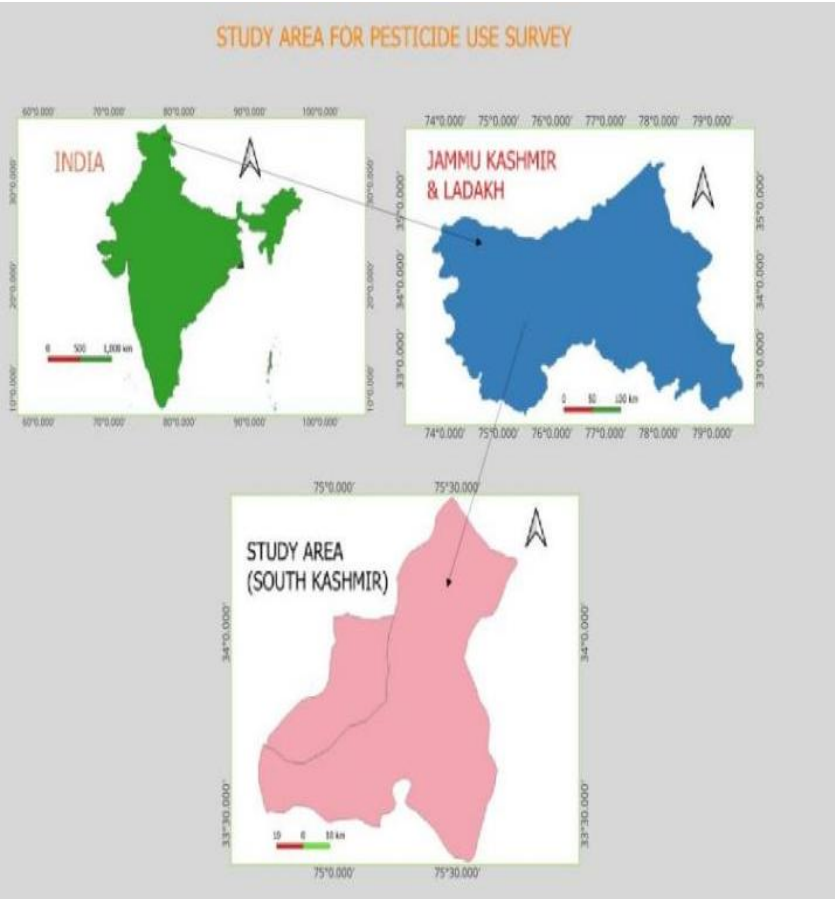


Fig. 1: Study area for pesticide use survey

Table 1: Details of the study area for pesticide use in Kashmir valley

District	Block	Village	Lat	Long	Altitude
Kulgam	DH Pora	DH Pora	33.62 ° N	74.95 ° E	5472ft
		Bathi Pora	33.62 ° N	74.90 ° E	5468ft
		Waripora	33.61 ° N	74.93 ° E	5486ft
	Pombay	Mirhama	33.66 ° N	74.98 ° E	5377ft
		Pombay	33.65 ° N	74.95 ° E	5383ft
		Samnoo	33.65 ° N	74.92 ° E	5387ft
Pulwama	Tral	Seer	33.91 ° N	75.09 ° E	5390ft
		Arigam	33.92 ° N	75.09 ° E	5354ft
		Khasipora	33.95 ° N	75.12 ° E	5340ft
	Pulwama	Pulwama	33.87 ° N	74.90 ° E	5419ft
		Lassipora	33.82 ° N	74.94 ° E	5508ft
		Pingal gam	33.93 ° N	74.90 ° E	5460ft
Shopian	Zainapora	Wachi	33.78 ° N	75.07 ° E	5280ft
		Zain Pora	33.79 ° N	75.00 ° E	5230ft
		Reshi Pora	33.71 ° N	74.95 ° E	5210ft
	Shopian	Aglar	33.75 ° N	74.85 ° E	6749ft
		Dasso	33.78 ° N	74.96 ° E	6750ft
		Hajipora	33.71 ° N	74.91 ° N	6760ft
Anantnag	Bijbehara	Arwani	33.78° N	75.07°E	5225ft
		Sangam	33.82° N	75.08°E	5233ft
		Marhama	33.84 ° N	75.09 ° E	5220ft
	Larnoo	Dandi Pora	33.55°N	75.37° E	6750ft
		Larnoo	33.63 ° N	75.37 ° E	6670ft
		Iqbalpora	33.59 ° N	75.38 ° E	6630ft

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RESULTS AND DISCUSSION

Data presented in Table 2 & Fig. 2 indicates variability in the adoption level of spray schedules among the farmers of different districts.

Table 2: Adoption level (%) of recommended spray schedule in apple by various respondents across studied districts

District	Adoption rate (% farmers)							
	<40		40-60		60-80		>80	
	2021	2022	2021	2022	2021	2022	2021	2022
Pulwama	34.3	33.7	18.9	23.4	24.6	23.2	22.2	17.6
Shopian	23.1	25.3	16.2	17.2	30.5	27.8	30.2	27.8
Kulgam	18.8	19.5	19.5	21.6	33.2	28.2	28.5	28.2
Anantnag	25.4	23.9	21.5	23.7	28.8	27.9	24.3	26.5

Fig. 2 shows that overall a very less number of respondents (25.9%) adopted the spray schedule (above 80%). 27.84% adopted 60-80%, 20.89% adopted 40-60 % and 25.36 % adopted less than 40% of the recommended spray schedule. Data in Fig 2 shows that among the districts, Shopian registered the highest adoption rate (above 80%) of spray schedule (29.25%) followed by Kulgam (28.55%). Adoption was found least (less than 40%) in district Pulwama (20.25%). These results indicate that there is scope for creating mass awareness about the spray schedule which is developed after a lot of scientific research by the State Agriculture University. According to the researcher's adoption level of spray schedule or any other agricultural technology depends on many factors like willingness to adopt, type of growers, land holding, level of education, the influence of pesticide dealers, socio-economic condition, personal experience, availability of pesticides in the locality, extension system, publicity system and above all weather conditions and level of infestation (Singh, 1973; Beigh, 1998; Baba *et al*., 2012; Mir *et al*., 2017; Khan *et al*., 2022; Khan and Bae, 2017).

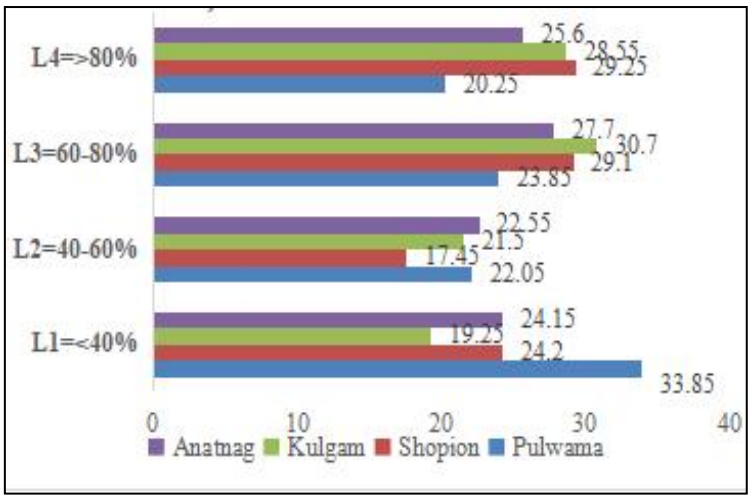


Fig. 2: Adoption rate of spray schedule (% farmers) in different districts

The data on the number of pesticides sprayed was averaged and is presented in Fig 3, which indicates that Pulwama ranked 1st in the number of pesticides sprayed during the entire growing season of apple (17.8) while in district Anantnag respondents used 14.2 sprays which was the lowest from the entire eight blocks across South Kashmir. A maximum number of fungicides (11.8) were sprayed in Pulwama followed by Kulgam (10.7), Anantnag (10.5), and Shopian (9.8). So far as the insecticides are concerned the highest number of sprays were carried out in Pulwama (3.2) followed by Shopian (2.7). The lowest number of insecticide sprays was conducted in Anantnag. Similarly, more acaricides+HMO were used by Pulwama apple growers as compared to other growers of South Kashmir.

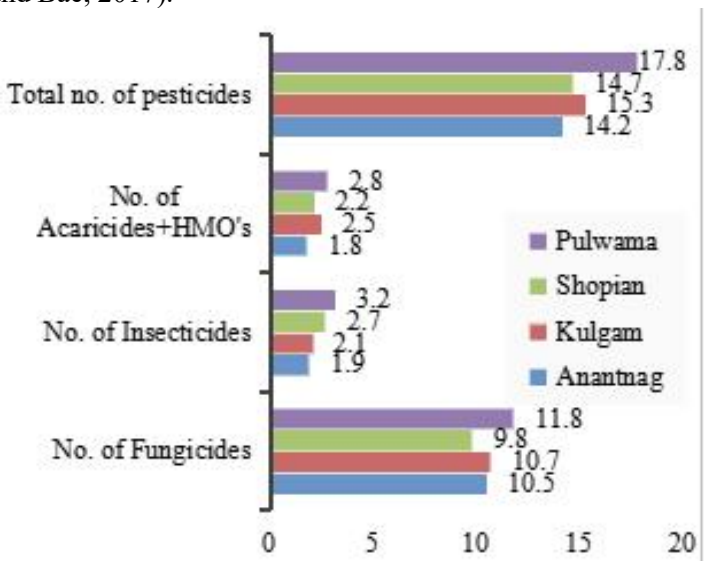


Fig. 3: Average number of pesticides used across the districts

The variation in the use number of pesticides applied by apple growers among the four districts might be due to the difference in the level of infestation, spray cover after precipitation, information dissemination system, and other management practices as indicated in earlier reports (Mir *et al*., 2017; Beigh, 1998; Aziz *et al*., 2018). Baba *et al*. (2015) reported that pesticides are applied to apples without an adequate understanding of pest ecology, economic injury level, formulation/methods, and safety measures during pesticide application and it varies between different apple growers in Kashmir Valley.

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Data in Fig. 4 depicts that pesticide cost per hectare varied a lot between the districts of South Kashmir. On average the pesticide costs during the apple growing season were maximum (Rs.109870/ha) in Pulwama and minimum in district Kulgam (Rs.97360/ha). Fungicides contribute a maximum portion of total pesticide costs (67.54%). Pulwama leads in terms of money spend on fungicides (Rs.74700/ha) followed by Shopian (Rs.70880/ha). Maximum costs on acaricides (Rs.12500/ha) and insecticides (Rs.10880/ha) were also incurred by Pulwama farmers, while Shopian ranked 1st as far as HMOs are concerned (Rs.13860/ha). These costs were the amount spend on agrochemicals excluding labor, fuel, or any other miscellaneous cost during plant protection operation. The variability in pesticide costs may be attributed to variations in the number of pesticides sprayed, different brands of chemicals used, level of plant protection knowledge, and other socio-economic aspects. These results are in concordance with those of Siddiqui *et al*., 2006; Baba *et al*., 2015 and Naqash *et al*., 2019.

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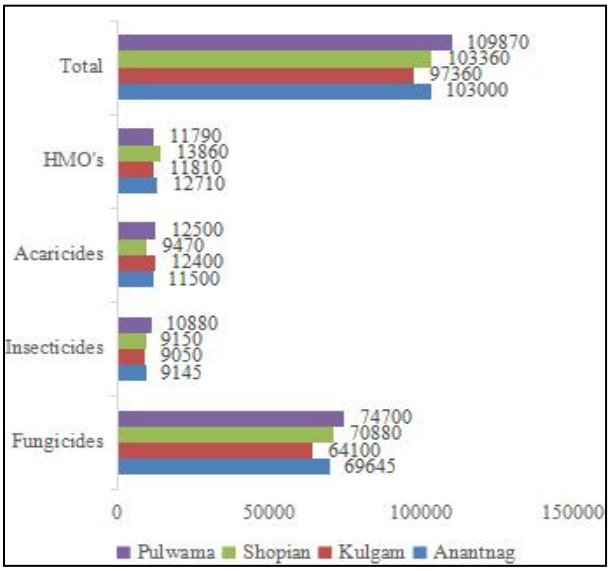


Fig 4: Average cost incurred on pesticides in different districts

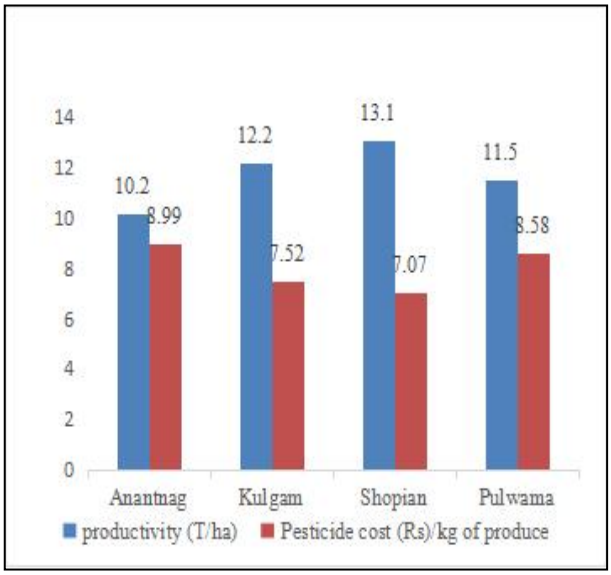


Fig 5: Average productivity and cost incurred on pesticides

After obtaining the average productivity data from surveyed farmers representing different districts, pesticide productivity in terms of pesticide cost/kg of apple produce was derived as shown in figure 5. Higher crop productivity (13.1 t/ha) was registered in district Shopian and the lowest in Anantnag. This may be because Shopian is traditionally an apple belt possessing a suitable climate for apple production and Anantnag which is comparatively a lower altitude and has recently switched over from paddy to apple farming. The cost incurred on pesticide per unit production of fruit was lowest in the district Shopian (Rs.7.07/kg apple) followed by Kulgam (Rs.7.52/kg apple) and highest in the case of Anantnag (Rs.8.99/kg apple).

This may be due to higher apple productivity and less amount of pesticide cost per unit area in Shopian compared to other districts. Variation in pesticide use and apple productivity in different parts of Kashmir valley has been earlier reported by Baba *et al*., 2017; Naqash *et al*., 2019; Mir, 2017; Anonymous, 2021.

CONCLUSION

The comparative analysis of pesticide use in South Kashmir's apple production reveals significant variability in the adoption of recommended spray schedule, with only 25.9% of farmers adhering

to >80% of the schedule. District Pulwama recorded the highest pesticide use and costs, while Anantnag reported the lowest usage and productivity. Shopian showed optimal efficiency with the highest productivity and lowest pesticide cost per kg of fruit. These findings highlight the need for increased awareness, training, and extension services to promote judicious pesticide use. Adopting recommended and scientific based practices can enhance productivity, reduce environmental risks, and improve farm profitability across the study area.

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REFERENCES

Anonymous. 2021. District-Wise/kind-wise estimated area and production under major horticulture crops in J&K during the year 2021-22. Directorate of Horticulture-Kashmir.

Aziz, R., Siddiqui, B.N. and Ali, J. 2018. Relationship between socio-economic aspects of farmers and their awareness & adoption of short agricultural messages telecast on P.TV. *International Journal of Advanced Research in Biological Sciences*, **5**: 25-33.

Baba, S.H., Malik, H.A., Mir, S.A., Hamid, Y. and Kachroo, M.M. 2017. Externalities of Pesticide Application on Apple in Kashmir Valley. *Agricultural Economics Research Review*, **30**: 81-92.

Baba, S.H., Wani, M.H. and Wani, S.A. 2015. Pesticide Application on Apple: Issues of Marketing and Ecological Implications. Policy Paper, Kashmir and Ladakh Agriculture Watch Centre, Directorate of Research. Policy Research Series DR-SKUASTK/ 2015-10, SKUAST Kashmir.

Baba, S.H., Wani, M.H. Zargar, B.A. Wani, S.A. and Kubrevi, S.S. 2012. Pesticide delivery system in apple growing belt of Kashmir valley. *Agricultural Economics Research Review*, **25**:435-44.

Beigh, M.A. 1998. Disease and pest management of apple in J&K: Technology, Adoption, and Constraints: Doctoral Thesis, College of Agriculture, CCS Haryana Agricultural University (unpublished).

Bhat, T.A. and Choure, T. 2014. Status and Strength of Apple Industry in Jammu and Kashmir. *International Journal of Research*, **1**: 277-83.

Boyer, J., Liu, R.H. 2004. Apple phytochemicals and their health benefits. *Nutrition Journal*. **3**, 5. https://doi.org/10.1186/1475-2891-3-5.

Hundal, B.S., Anada. and Ramanadeep, S. 2006. Pesticide Marketing. The Indian Scenario. *Journal of Economics and Management*, **4**: 32-37.

Khan, M. and Bae, J.H. 2017. The environmental perspectives of apple fruit supply chain management in Chitral, Northern Pakistan. *International Journal of Supply Chain Management*, **6**: 1-16.

Khan, N., Ray, R.L., Ihtisham, M., Siddiqui, B.N., Khayyam, M., Anjum, R. and Asongu, S.A. 2022. Socioeconomic determinants of the awareness and adoption of apple production practices: A case study of Balochistan, Pakistan. *Sarhad Journal of Agriculture*, **38**: 322-30.

Mir, R., Beigh, M.A., Shah, Z.A., Singh, R., Matoo, J.M. and Dar, M.A. 2017. An evaluation of the extent and gap in adoption in recommended apple spray schedule of the apple growers. *Journal of Entomology and Zoology Studies*, **5**: 2184-89.

Mubarak, T.**,** Khanday**,** A. S., Shergojry, S.A. and Rehman, H.U. 2023. Impact of Integrated Farming System (IFS) on crop production and farm income under Temperate Hill Ecology. *SKUAST Journal of Research*, **25**: 141-45

Naqash, F., Wani, S.A., Mir, S.A., Wani, W.M., Baba, S.H. and Malik, H.A. 2019. Economics of Pesticide Use in the Apple producing areas of Kashmir Valley. *International Journal of Advance Research and Innovative Ideas in Education*, **5:** 68-80.

Reshi, M.I., Malik, M.A. and Vijay, K. 2010. Assessment of problems and prospects of apple production and marketing in Kashmir Valley, India. *Journal of Environmental Research and Development*, **4**: 1077-82.

Siddiqui, B.N., Muhammad, S. and Malik, N.H. 2006. Effect of socio-economic aspects on awareness and adoption of recommended horticultural practices by apple growers in Balochistan. *Pakistan Journal of Agricultural Sciences*, **43**: 73-76.

Singh, R.N. 1973. Characteristics of farm innovations associated with the rate of adoptions. *Indian Journal of Agricultural Economics*, **24**: 71-78.

Wani, S.A., Kumar, S., Naqash, F., Shaheen, F.A., Wani, F.J. and Rehman, H.U. 2021. The potential of apple cultivation in doubling farmer's income. *Indian Journal of Agricultural Economics*, **76**: 278-91.

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