



# Knowledge Gain through Instructional Videos among Tomato Growers of Central Plain Zone of Punjab, India

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**Abstract:** This study evaluated the effectiveness of instructional videos in enhancing tomato growers' knowledge of recommended cultivation practices. Utilizing Information and Communication Technology (ICT), the research involved 160 tomato growers from Amritsar and Patiala districts, selected through multistage sampling. Five targeted videos covering essential aspects of tomato cultivation were developed and presented to the respondents. The study measured knowledge levels before and after exposure to the videos, revealing a significant increase in knowledge retention. After exposure to the videos, 52.5 per cent of respondents achieved a high level of knowledge, a substantial rise from 22.5 per cent prior to the intervention, reflecting a notable 30.0 per cent shift in high knowledge levels. Additionally, respondents exhibited enhanced understanding in various aspects of tomato cultivation, including nursery raising, pest management, and irrigation practices. The findings highlight the efficacy of instructional videos as a powerful medium for agricultural education and underscore the role of ICT in effectively disseminating agricultural knowledge. Based on the positive outcomes, the study recommends the broader adoption of video-based learning tools to improve knowledge dissemination among farmers, ultimately contributing to better agricultural practices and productivity.

**Keywords:** Instructional videos, ICT in agriculture, Tomato cultivation, Information dissemination

The use of Information and Communication Technology (ICT) across various sectors of the global economy has proven to be a game changer in enhancing work efficiency and productivity. Agriculture is one sector that has benefited immensely from ICT integration. Daum (2020) concluded that, ICT has become pivotal for farmers in managing key production factors such as land, labor, capital, and soil. This technology is increasingly being utilized to address diverse challenges in agriculture, including prolonged droughts, pest outbreaks, seasonal variations, and the geographical dispersion of farming activities. Anh et al (2019) further highlight ICT's potential to mitigate issues like high transaction costs and information asymmetry in agriculture. Applying ICT throughout the agricultural value chain, from production to consumption, equips stakeholders with precise, timely, and relevant information. This not only enhances profitability but also promotes food security and sustainable agriculture (Purnomo and Lee 2010).

Farmers also use ICT platforms to provide feedback on new technologies based on their field experiences, which extension workers then relay to research institutions for further refinement (Nyarko and Kozári 2021). Digital extension methods, in use for many years in agricultural extension, play a critical role in this transformation. The application of ICT to tackle a wide range of development challenges has drawn significant attention from governments, practitioners, and researchers (Lwoga and

Sangeda 2019, Arulkumar et al 2021, Acharya et al 2022). This shift toward digital tools not only enhances knowledge dissemination but also broadens access to agricultural information, contributing to the advancement of the agricultural sector. There is growing research on how ICTs are used in smallholder agriculture in developing countries, significant uncertainties remain regarding the effectiveness of emerging ICT-based approaches (Aker 2011, Nakasone and Torero 2016). This is particularly true in the realm of ICT-driven agricultural extension services aimed at improving farmers' management of crops, livestock, and natural resources. Previous studies have explored the impact of basic, cost-effective text and voice messaging services delivered via mobile phones, yet more advanced methods have received limited attention. These advanced approaches include the use of videos to convey information to farmers through intermediaries such as community organizers or extension workers, using tools like portable projectors, tablets, and computers. Videos, a relatively recent technological innovation in agriculture, hold great potential for addressing the challenges of information dissemination, particularly for the poor, marginalized, farm women, and young farmers. The application of videos in agriculture ranges from raising awareness and generating demand for support, to facilitating farmer-to-farmer extension, providing training on innovations, fostering creativity, and serving as tools for documentation,

monitoring, and evaluation (Bentley et al 2015). Whether used independently or in conjunction with conventional extension approaches, videos stand out as a powerful medium for information dissemination (Abate et al 2019). The present study aims to assess the effectiveness of instructional videos in enhancing farmers' knowledge, specifically focusing on recommended tomato cultivation practices.

## MATERIAL AND METHODS

**Research design:** In the present study, a quasi-experimental design was employed to estimate the effectiveness of instructional videos on the knowledge level of tomato growers regarding recommended practices for cultivation of tomato crop.

**Location of study area:** For the present study, two districts, Amritsar and Patiala, were purposively selected based on their highest area under tomato cultivation in the state (Department of Agriculture, Punjab 2023). Amritsar, located at 31.63°N latitude and 74.87°E longitude, with an elevation of 234 meters, experiences a semi-arid to subtropical climate and receives 500-600 mm of rainfall annually. Its well-drained alluvial soils are ideal for tomato farming. Patiala situated at 30.33°N latitude and 76.40°E longitude, at an elevation of 250 meters, experiences a similar climate, receiving 700 mm of rainfall per year. Its loamy to sandy loam soils also support significant tomato cultivation. A multistage sampling technique was used to select the blocks and villages. A total of 160 tomato growers were selected for the study.

**Gain in knowledge:** To evaluate this gain, five knowledge tests were developed, each covering crucial aspects presented in the instructional videos. These aspects included nursery raising, weeds and irrigation schedules, insect pest management, virus and diseases management and harvesting methods were prepared. These knowledge tests consisted of 21, 9, 15, 21 and 9 statements respectively. Each statement in these tests required respondents to provide answers in various formats, such as yes or no, fill in the blank, match the following and multiple-choice questions. A score of 1 was assigned to correct answers, while incorrect responses received a score of 0. Subsequently, the scores for each respondent were aggregated and based on the total scores, respondents were categorized into three knowledge levels by using range methods i.e. low, medium and high. After exposing the respondents to the videos, the post-exposure data was collected after a gap of 20-30 days. Total scores obtained by the respondents at the pre and post-test was determined and the difference was calculated.

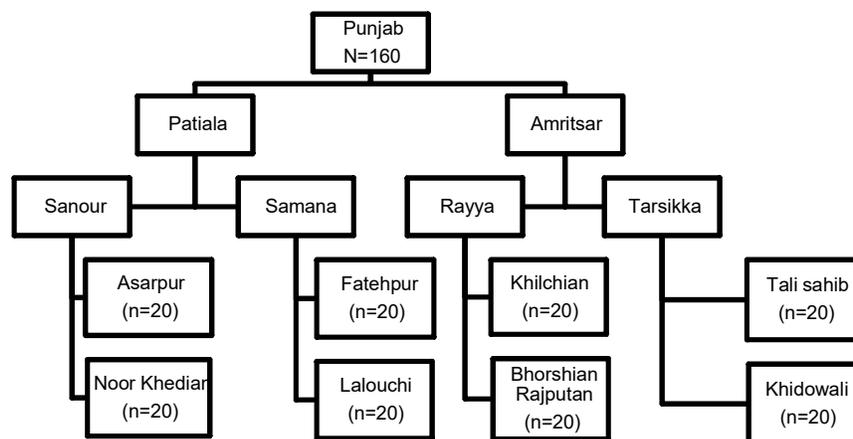
$$\text{Gain in knowledge} = X_2 - X_1$$

Where,

X1= Test score in a pre-exposure test

X2= Test score in a post-exposure test

**Video description:** In total, five videos were developed on various aspects of tomato cultivation. These videos have been submitted to the Department of Vegetable Science and the Communication Centre of Punjab Agricultural University, Ludhiana (PAU) for further dissemination and use in farmer outreach programs.



| Video topic   | Duration                 |
|---|--------------------------|
| Nursery raising   | 6 minutes and 27 seconds |
| Harmful effects of weeds and their management & irrigation scheduling | 3 minutes and 43 seconds |
| Harmful effects and management of insect pests                        | 3 minutes and 5 seconds  |
| Harmful effects and management of diseases                            | 4 minutes and 32 seconds |
| Harvesting stages of tomato fruit                                     | 2 minutes and 4 seconds  |

**RESULTS AND DISCUSSION**

**Gain in knowledge of respondents regarding various practices of tomato cultivation:** The study employed a pre-test to assess farmers' baseline knowledge of tomato cultivation practices before exposing them to instructional videos. A subsequent post-test evaluated knowledge gains, allowing for a comparison that quantified the effectiveness of the videos in enhancing understanding across key areas, including nursery raising, irrigation scheduling, weed management, pest control, disease management, and harvesting indices.

**Nursery raising video:** The soil solarization knowledge

improved by 25.0 per cent, increasing from 36.3 to 61.3 per cent of respondents, while seed treatment before sowing knowledge showed an 18.1 per cent increase. Similarly, understanding of chemical seed treatment (Captan/Thiram) improved by 17.5 per cent. The most substantial gain was observed in the knowledge of using plug trays for raising seedlings, with a 28.1 per cent improvement, from 45.0 to 73.1 per cent. These shifts underscore the effectiveness of the videos in conveying critical information, as evidenced by a significant improvement in respondents' understanding of essential practices. The instructional videos were structured with visual aids and practical demonstrations, which

**Table 1.** Knowledge gain before and after the exposure to instructional video on nursery raising (n=160)

| Item   | Exposure            |                    |         | Z test |
|--|---------------------|--------------------|---------|--------|
|  | Before exposure (%) | After exposure (%) | % shift |        |
| Soil solarization  | 58<br>(36.3)        | 98<br>(61.3)       | 25.0    | 4.47*  |
| Seed treatment before sowing   | 84<br>(52.5)        | 113<br>(70.6)      | 18.1    | 3.33*  |
| Chemical used for seed treatment (Captan/Thiram)   | 71<br>(44.4)        | 99<br>(61.9)       | 17.5    | 3.14*  |
| Recommended dose of Captan for seed treatment (3g/kg)  | 40<br>(25.0)        | 70<br>(43.8)       | 18.8    | 3.53*  |
| Nursery area required to raise seedlings for an acre (2 marla)   | 90<br>(56.3)        | 110<br>(68.8)      | 12.5    | 2.31*  |
| Raised nursery beds are recommended for raising nursery  | 124<br>(77.5)       | 141<br>(88.1)      | 10.6    | 2.52*  |
| Plug trays are recommended for raising nursery   | 72<br>(45.0)        | 117<br>(73.1)      | 28.1    | 5.12*  |
| Line to line spacing of seeds when sown in nursery beds (5cm)  | 52<br>(32.5)        | 89<br>(55.6)       | 23.1    | 4.17*  |
| Optimum planting depth of seed (1-2 cm)  | 112<br>(70.0)       | 126<br>(78.8)      | 8.8     | 1.79   |
| In plug tray, number of seeds sown per plug (1 seed)   | 43<br>(26.9)        | 76<br>(47.5)       | 20.6    | 3.82*  |
| Mixture used in plug tray (cocopeat+ vermicompost+ perlite)  | 50<br>(31.3)        | 78<br>(48.8)       | 17.5    | 3.20*  |
| The mulch applied in nursery should be removed after (5-7 days)  | 81<br>(50.6)        | 112<br>(70.0)      | 19.4    | 3.54*  |
| Symptoms of damping off  | 102<br>(63.8)       | 108<br>(67.5)      | 3.8     | 0.71   |
| Chemical used to control damping off (Captan)  | 52<br>(32.5)        | 81<br>(50.6)       | 18.1    | 3.29*  |
| Recommended dose of Captan for damping off (4g/liter of water)   | 37<br>(23.1)        | 59<br>(36.9)       | 13.8    | 2.68*  |
| Time of application (after 5-7 days of germination)  | 56<br>(35.0)        | 83<br>(51.9)       | 16.9    | 3.05*  |
| The chemical should be repeated after (7-10 days)  | 41<br>(25.6)        | 70<br>(43.8)       | 18.1    | 3.41*  |
| Withhold irrigation to strengthen seedling for better field establishment (4-5 days)                             | 33<br>(20.6)        | 87<br>(54.4)       | 33.8    | 6.24*  |
| Seedlings are ready for transplanting (4-6 weeks)  | 120<br>(75.0)       | 135<br>(84.1)      | 9.4     | 2.08*  |
| Advantages of raising nursery in plug trays (higher germination, healthy plants with good root development etc.) | 67 (41.9)           | 92 (57.5)          | 15.6    | 2.72*  |
| Closed spacing of seedling leads to high incidence of insect-pests and diseases                                  | 67<br>(41.9)        | 93<br>(58.1)       | 16.3    | 2.91*  |

\*Significant at 0.05 level

facilitated improved comprehension and retention. Smith et al (2020), also demonstrated that instructional videos significantly improved farmers' knowledge of best practices in crop cultivation. Similarly, Vasilaky et al (2015) and Van Campenhout et al (2017) reported significant gains in knowledge and technology adoption among farmers following video-based interventions. Moreover, increase was observed in respondents' awareness of chemical usage for controlling damping-off disease and the importance of withholding irrigation to strengthen seedlings. Jones and Patel (2018), Gupta et al (2019), and Rahman et al (2021) also mentioned a the positive impact of instructional videos on agricultural practices.

Initially, about 41.2 per cent of the respondents were categorized as having a low level of knowledge, 38.1 per cent had a medium level and 20.6 per cent had a high level of knowledge (Table 2). However, after watching the video, there was a significant change in knowledge level, about 46.2 per cent of the respondents falls in the category of high level of knowledge, 24.4 per cent were having a medium level and

29.4 per cent remained at a low level. This represents an increase of 25.6 per cent in the proportion of respondents achieving a high knowledge level following the video exposure. These changes were statistically significant at, highlighting the effectiveness of the video in enhancing the respondents' knowledge about nursery raising. Vikram (2000) and Pandian et al (2002) also demonstrated an increase in respondents' knowledge following exposure to farm videos.

**Irrigation and weed management video:** There was significant knowledge improvements among respondents regarding irrigation scheduling and weed management practices after exposure to instructional videos. Before viewing, only 55.0 per cent of respondents recognized that water deficit conditions adversely affect fruit size and quality, this figure rose to 70.0 per cent post-exposure, indicating a 15.0 per cent increase (Table 3). Similarly, awareness of the detrimental effects of waterlogging on plant roots increased from 33.1 per cent to 46.9 per cent, representing a 13.8 per cent gain. Knowledge of critical irrigation stages also

**Table 2.** Distribution of respondents on the basis of their level of knowledge before and after the exposure to the nursery raising video (n=160)

| Instructional content in video | Level of knowledge | Before exposure (%) | After exposure (%) | % shift | Z test |
|--------------------------------|--------------------|---------------------|--------------------|---------|--------|
| Nursery raising                | Low (0-7)          | 66<br>(41.2)        | 47<br>(29.4)       | -11.9   | 2.21*  |
|                                | Medium (8-14)      | 61<br>(38.1)        | 39<br>(24.4)       | -13.8   | 2.64*  |
|                                | High (15-21)       | 33<br>(20.6)        | 74<br>(46.2)       | +25.6   | 4.85*  |

\*Significant at 0.05 level

**Table 3.** Knowledge gain before and after the exposure to instructional video on the irrigation and weed management (n=160)

| Items   | Before exposure (%) | After exposure (%) | % shift | Z test |
|---|---------------------|--------------------|---------|--------|
| Under water deficit conditions, the tomato crop experiences a reduction in fruit size and a decline in tomato quality | 88<br>(55.0)        | 112<br>(70.0)      | 15.0    | 2.77*  |
| Water logging causes severe damage to plant by reducing supply of oxygen to the plant roots                           | 53<br>(33.1)        | 75<br>(46.9)       | 13.8    | 2.52*  |
| Critical stage of irrigation is flowering and fruiting stage  | 47<br>(29.4)        | 72<br>(45.0)       | 15.6    | 2.89*  |
| Subsequent irrigation may be given after 6-7 days in summer   | 69<br>(43.1)        | 93<br>(58.1)       | 15.0    | 2.68*  |
| Subsequent irrigation may be given after 14-15 days in winter   | 69<br>(43.1)        | 84<br>(52.5)       | 9.4     | 1.68   |
| Recommended soil conditions for applying weedicide (Moist)  | 70<br>(43.8)        | 90<br>(56.3)       | 12.5    | 2.24*  |
| Weed limit the growth of tomato plants due to competition for nutrient, light, water and space                        | 82<br>(51.3)        | 101<br>(63.1)      | 11.9    | 2.13*  |
| Pre-emergence application of weedicide to prevent weed (Sencor 70WP (metribuzin))                                     | 86<br>(53.8)        | 102<br>(63.8)      | 10.0    | 1.82   |
| Recommended dose of Sencor (300g/200 liter of water)  | 57<br>(35.6)        | 69<br>(43.1)       | 7.5     | 1.37   |

\*Significant at 0.05 level

improved, with respondents understanding that these occur during flowering and fruiting stages, which increased from 29.4 per cent to 45.0 per cent (15.6 per cent rise). Moreover, awareness of appropriate irrigation schedules was enhanced, with significant shifts observed in the understanding of timing for subsequent summer and winter irrigation. The findings illustrate a substantial shift in respondents' overall knowledge levels regarding irrigation and weed management practices, as a higher percentage demonstrated enhanced understanding post-exposure. Chen et al (2018) and Kumar et al (2020) also highlight the effectiveness of instructional videos in agricultural education. These statistically significant changes in knowledge levels affirm the videos' efficacy in bolstering essential skills related to irrigation and weed management, ultimately contributing to improved agricultural outcomes.

The study indicated that before exposure about 44.4 per cent of respondents had low level of knowledge about irrigation scheduling and weed management, followed by 37.5 per and 18.1 percent with a medium and high level of knowledge (Table 4). However, after exposure, 35.6 per cent of respondents have high level of knowledge followed by 32.5 and 31.9 per cent medium and low level. These findings suggest that the video on irrigation scheduling and weed management practices in tomato crops served as an effective intervention, increasing the proportion of respondents with a high level of knowledge by 17.5 per cent.

**Insect-pest management video:** The 32.5 per cent of respondents were having knowledge regarding the weed flora various areas serve as a reservoir for whitefly and aphids before exposure which increased significantly to 50.6 per cent after exposure. Understanding of the adverse effects of excessive nitrogenous fertilizer on insect pest multiplication improved by 20.6 per cent (Table 5). Additionally, awareness that seedlings are susceptible to pest infestation in the nursery rose from 52.0 per cent to 68.0 per cent after exposure. Awareness of the insecticide used to control whiteflies, Malathion 50 EC, increased by 6.3 per cent after exposure to the video. Knowledge of the recommended dose

of Malathion (400 ml in 100 litres of water) rose from 38.1 per cent to 48.8 per cent, while awareness for aphids increased from 30.6 per cent to 45.0 per cent, indicating increases of 10.6 per cent and 14.4 per cent, respectively. Knowledge regarding the aphid-transmitted disease (Mosaic) rose significantly by 16.3 per cent. Understanding of insecticides used for fruit borer control increased from 79.4 per cent to 85.6 per cent. Additionally, there was about a 15 per cent increase in proportion of respondents regarding employing trap crops like marigold for fruit borer. Awareness of challenges in controlling insect pests saw a significant increase of 32.5 per cent. These results demonstrate the effectiveness of instructional videos in enhancing farmers' knowledge of insect-pest management, supporting findings by Palakkal and Chinnaiyan (2010) and Van Campenhout et al (2017).

The 40.6 per cent of respondents had a medium level of knowledge regarding insect-pest control in tomato crops, 37.5 per cent had a low level and 21.9 per cent had a high level of knowledge before exposure (Table 6). However, after exposure to the insect-pest control video, 47.5 per cent of respondents had a high level of knowledge, 29.4 per cent had a medium level and 23.1 per cent had a low level of knowledge. The findings reveal a significant shift of 14.4 per cent decrease in the proportion of respondents with a low level of knowledge and 25.6 per cent increase in those with a high level of knowledge. This indicates that the video was effective in enhancing the respondents' knowledge about insect-pest control in tomato crops. The calculated 'z' value confirms that these changes were statistically significant at the 0.05 level. These results underscore the effectiveness of informational videos as a tool for improving knowledge in agricultural practices. The substantial increase in the high knowledge category suggests that such interventions can play a crucial role in disseminating important information and improving farming outcomes. The results are in line with the findings of Cai (2015) and Chowdhury et al (2015).

**Disease management video:** There was significant enhancements in respondents' knowledge regarding disease management practices in tomato cultivation after exposure to

**Table 4.** Distribution of respondents on the basis of their level of knowledge before and after exposure to the irrigation and weed management video

| Type of instructional content in video | Level of knowledge | Before exposure (%) |              | % shift | Z test |
|--|--------------------|---------------------|--------------|---------|--------|
|  |                    | f (%)               | f (%)        |         |        |
| Irrigation and weed management         | Low (0-3)          | 71<br>(44.4)        | 51<br>(31.9) | -12.5   | 2.30   |
|  | Medium (4-6)       | 60<br>(37.5)        | 52<br>(32.5) | -5.0    | 0.94   |
|  | High (7-9)         | 29<br>(18.1)        | 57<br>(35.6) | +17.5   | 3.53   |

\*Significant at 0.05 level

instructional videos. Knowledge of disease transmission through infected seeds increased from 52.5 per cent to 66.3 per cent, reflecting a 13.8 per cent shift (Table 7). Similarly, awareness of seed treatment with fungicide rose from 46.3 per cent to 59.4 per cent, while understanding of disease prevention measures, such as crop rotation and soil sterilization, saw an increase from 38.1 per cent to 51.3 per cent. The knowledge of specific symptoms and control measures for diseases like early blight improved substantially, with recognition of symptoms rising from 49.4 per cent to 59.4 per cent. Moreover, significant shifts in knowledge regarding

control measures for leaf curl and the impacts of monoculture practices on disease infestation were observed. The awareness about the relationship between previous crop residues and late blight increased from 37.5 per cent to 61.9 per cent, marking a 24.4 per cent shift. Overall, the proportion of respondents with high knowledge levels rose dramatically from 18.1 per cent to 46.9 per cent post-exposure, indicating a profound impact of the instructional videos.

Forty-five per cent of respondents had a low level of knowledge about disease management, followed by 36.9 per cent with a medium level and 18.1 per cent with a high level

**Table 5.** Knowledge gain before and after the exposure to instructional video on insect-pest management

| Item   | Before exposure (%) | After exposure (%) | % shift | Z test |
|--|---------------------|--------------------|---------|--------|
| Weeds growing on field bunds, wastelands, roadsides and along irrigation canals serve as reservoirs for whiteflies and aphids. | 52<br>(32.5)        | 81<br>(50.6)       | 18.1    | 3.29*  |
| Excessive use of Nitrogenous fertilizer encourages multiplication of insect pests  | 35<br>(21.9)        | 68<br>(42.5)       | 20.6    | 3.95*  |
| Tomato seedlings in the nursery are vulnerable to pest infestations, particularly from whiteflies.                             | 83<br>(51.9)        | 109<br>(68.1)      | 16.3    | 2.97*  |
| Regularly collection of infested fruits and destruction by burying them deep in the soil.                                      | 63<br>(39.4)        | 86<br>(53.8)       | 14.4    | 2.58*  |
| Insecticide used to control whitefly (Malathion 50 EC)   | 114<br>(71.3)       | 124<br>(77.5)      | 6.3     | 1.27   |
| Recommended dose of insecticide (400ml in 100 litres of water)   | 61<br>(38.1)        | 78<br>(48.8)       | 10.6    | 1.93   |
| Leaf curl virus transmitted by whitefly disease  | 110<br>(68.8)       | 120<br>(75.0)      | 6.3     | 1.93   |
| Insecticide used to control aphid (Malathion 50 EC)  | 90<br>(56.3)        | 104<br>(65.0)      | 8.8     | 1.23   |
| Recommended dose of insecticide (400ml in 100 litres of water)   | 49<br>(30.6)        | 72<br>(45.0)       | 14.4    | 1.59   |
| Aphid transmitted disease (Mosaic)   | 50<br>(31.3)        | 76<br>(47.5)       | 16.3    | 2.66*  |
| Symptoms of fruit borer  | 140<br>(87.5)       | 156<br>(97.5)      | 10.0    | 2.97*  |
| Insecticide used to control fruit borer (Coragen 18.5 SC/ Indoxcarb 14.5 SC/ Fame 480 SL)                                      | 127<br>(79.4)       | 137<br>(85.6)      | 6.3     | 3.40*  |
| Recommended dose of insecticide (60ml/ 200ml/ 30ml)  | 50<br>(31.3)        | 73<br>(45.6)       | 14.4    | 1.46   |
| Ideal trap crop for tomato fruit borer (Marigold)  | 78<br>(48.8)        | 103<br>(64.4)      | 15.6    | 2.63*  |
| Facing challenges in effectively controlling insect pests (Change salt/insecticide)  | 58<br>(36.3)        | 110<br>(68.8)      | 32.5    | 2.82*  |

\*Significant at 0.05 level

**Table 6.** Distribution of respondents on the basis of knowledge before and after exposure to the insect-pest management video

| Type of instructional content in video | Level of knowledge | Before exposure (%) | After exposure (%) | % shift | Z test |
|--|--------------------|---------------------|--------------------|---------|--------|
| Insect-pest management                 | Low (0-5)          | 60<br>(37.5)        | 37<br>(23.1)       | -14.4   | 2.80*  |
|  | Medium (6-10)      | 65<br>(40.6)        | 47<br>(29.4)       | -11.3   | 2.11*  |
|  | High (11-15)       | 35<br>(21.9)        | 76<br>(47.5)       | +25.6   | 4.82*  |

\*Significant at 0.05 level

before exposure to the video (Table 8). However, after watching the disease management video, 46.9, 31.9 and 21.3 per cent of respondents attained a high, medium level

and low knowledge level. There was significant 28.8 per cent increase in respondents in the high knowledge category after exposure to the instructional video.

**Table 7.** Knowledge gain before and after the exposure to instructional video on disease management

| Items   | Before exposure (%) | After exposure (%) | % shift | Z test |
|---|---------------------|--------------------|---------|--------|
| Disease transmitted through infected seeds (Early blight, Damping off, Mosaic)                | 84<br>(52.5)        | 106<br>(66.3)      | 13.8    | 2.50*  |
| Seed treatment with fungicide reduces the disease occurrence in initial stages of crop growth | 74<br>(46.3)        | 95<br>(59.4)       | 13.1    | 2.35*  |
| Disease prevention measures (follow long crop rotation, soil sterilization)                   | 61<br>(38.1)        | 82<br>(51.3)       | 13.1    | 2.36*  |
| Symptoms of early blight  | 79<br>(49.4)        | 95<br>(59.4)       | 10.0    | 1.80   |
| Fungicide used to control early blight (Indofil M45)  | 123<br>(76.9)       | 131<br>(81.9)      | 5.0     | 1.11   |
| Recommended dose of fungicide (600g)  | 60<br>(37.5)        | 80<br>(50.0)       | 12.5    | 2.25*  |
| Repeat fungicide spray at interval of (7 days)  | 67<br>(41.9)        | 85<br>(53.1)       | 11.3    | 2.01*  |
| Symptom of late blight  | 71<br>(44.4)        | 91<br>(56.9)       | 12.5    | 2.24*  |
| Fungicide used to control late blight (Indofil M45) (Ridomil MZ 0.25%)                        | 119<br>(74.4)       | 125<br>(78.1)      | 3.8     | 0.79   |
| Recommended dose of fungicide (600-700g)  | 52<br>(32.5)        | 77<br>(48.1)       | 15.6    | 2.85*  |
| Repeat fungicide spray at interval of (7 days)  | 60<br>(37.5)        | 104<br>(65.0)      | 27.5    | 4.92*  |
| Previous crop residue causes late blight  | 60<br>(37.5)        | 99<br>(61.9)       | 24.4    | 4.36*  |
| Trap crop for disease   | 76<br>(47.5)        | 96<br>(60.0)       | 12.5    | 2.24*  |
| High rainfall and cool temperature favour the incidence of late blight disease                | 73<br>(45.6)        | 101<br>(63.1)      | 17.5    | 3.14*  |
| Indofil M45 is effective in managing both Early blight and Late blight disease                | 54<br>(33.8)        | 89<br>(55.6)       | 21.9    | 3.94*  |
| In leaf curl virus, plant remains unfruitful  | 82<br>(51.3)        | 112<br>(70.0)      | 18.8    | 3.43*  |
| Control measures of leaf curl (Rouge out and burn affected plants)                            | 53<br>(33.1)        | 91<br>(56.9)       | 23.8    | 4.27*  |
| Swelling root galls is a symptom of root-knot nematode  | 123<br>(76.9)       | 158<br>(98.8)      | 21.9    | 5.98*  |
| Green manuring with <i>Dhaincha</i> is not recommended in root-knot nematode infested fields  | 20<br>(12.5)        | 64<br>(40.0)       | 27.5    | 5.59*  |
| Green manure with marigold in root-knot nematode infested fields                              | 33<br>(20.6)        | 71<br>(44.4)       | 23.8    | 4.54*  |
| Monoculture increase infestation of root-knot nematode  | 82<br>(51.3)        | 118<br>(73.8)      | 22.5    | 4.16*  |

\*Significant at 0.05 level

**Table 8.** Distribution of respondents on the basis of knowledge before and after exposure to the disease management video

| Instructional content in video | Level of knowledge | Before exposure (%) | After exposure (%) | % shift | Z test |
|--------------------------------|--------------------|---------------------|--------------------|---------|--------|
| Disease management             | Low (0-7)          | 72<br>(45.0)        | 34<br>(21.3)       | -23.8   | 4.51*  |
|                                | Medium (8-14)      | 59<br>(36.9)        | 51<br>(31.9)       | -5.0    | 0.94   |
|                                | High (15-21)       | 29<br>(18.1)        | 75<br>(46.9)       | +28.8   | 5.49*  |

\*Significant at 0.05 level

**Harvesting of tomato fruit video:** There was significant enhancement in respondents' knowledge regarding harvesting practices for tomato cultivation following exposure to instructional videos. Knowledge about the importance of removing rotten, overripe, and borer-infested fruits for long-distance markets increased from 57.5 per cent to 73.8 per cent (Table 9). Additionally, understanding the necessity of avoiding harvesting immediately after chemical spraying improved from 66.3 per cent to 79.4 per cent. Post-exposure, respondents demonstrated advancements in post-harvest handling practices, with a 23.8 per cent shift in knowledge about pre-cooling fruits after harvesting and a 26.9 per cent shift regarding the total number of pickings based on various factors. The ability to identify the appropriate picking stages for different markets also saw significant improvements, with knowledge of local market requirements rising from 59.4 per cent to 80.6 per cent.

The 43.1 per cent of respondents belonged to the low knowledge level category, followed by 36.3 and 20.6 per cent in the medium and high knowledge level category (Table 10). However, after exposure to the harvesting indices video,

approximately 53, 30 and 17.5 per cent of the respondents high, medium level and low level of knowledge. There was significant increase of 31.9 per cent in the proportion of respondents who achieved a high knowledge level after exposure to harvesting indices video.

**Combined effectiveness of developed instructional videos on gain in knowledge:** The combined effect of all instructional videos on the respondents' knowledge gain presented in Table 11. Before exposure to the instructional videos, 46.9 per cent of respondents had a medium level of knowledge followed by 30.6 per cent low level and 22.5 per cent high level of knowledge. However, after exposure to the harvesting indices video, about 53 per cent of the respondents demonstrated high knowledge, 30 per cent medium knowledge, and 17.5 per cent low knowledge. This indicates a significant shift, with about a 30 per cent increase in the proportion of respondents in the high knowledge level category and a 16.3 per cent decrease in the low knowledge level category. These findings suggest that the instructional videos significantly enhanced the respondents' knowledge levels.

**Table 9.** Knowledge gain before and after the exposure to instructional video on harvesting of tomato fruit

| Items   | Before exposure (%) | After exposure (%) | % shift | 'z' test |
|---|---------------------|--------------------|---------|----------|
| For long distance markets, remove rotten, overripe and borer-infested fruits  | 92<br>(57.5)        | 118<br>(73.8)      | 16.3    | 3.06*    |
| Avoid harvesting tomatoes immediately after chemical spraying any plant protection chemicals  | 106<br>(66.3)       | 127<br>(79.4)      | 13.1    | 2.64*    |
| The fruits should be pre-cooled immediately after harvesting  | 26<br>(16.3)        | 64<br>(40.0)       | 23.8    | 4.72*    |
| The total number of pickings depends on the variety grown, susceptibility to diseases and insect pests and prevailing environmental conditions. | 73<br>(45.6)        | 116<br>(72.5)      | 26.9    | 4.89*    |
| Shrink and cling film extends marketing period of tomato by increasing shelf life   | 26<br>(16.3)        | 66<br>(41.3)       | 25.0    | 4.94*    |
| To hasten the ripening of harvested fruit, line plastic crates with newspapers  | 59<br>(36.9)        | 91<br>(56.9)       | 20.0    | 3.58*    |
| For long distance market, pick mature green fruits  | 89<br>(55.6)        | 126<br>(78.8)      | 23.1    | 4.41*    |
| For local market, pick fruit at ripen red stage   | 95<br>(59.4)        | 129<br>(80.6)      | 21.3    | 4.15*    |
| For processing, pick when fruits are fully red  | 120<br>(75.0)       | 141<br>(88.1)      | 13.1    | 3.03*    |

\*Significant at 0.05 level

**Table 10.** Distribution of respondents on the basis of knowledge before and after exposure to the harvesting of tomato fruit video

| Instructional content in video | Level of knowledge | Before exposure (%) | After exposure (%) | % shift | 'z' test |
|--------------------------------|--------------------|---------------------|--------------------|---------|----------|
| Harvesting of tomato fruit     | Low (0-3)          | 69<br>(43.1)        | 28<br>(17.5)       | -25.6   | 4.99*    |
|                                | Medium (4-6)       | 58<br>(36.3)        | 48<br>(30.0)       | -6.3    | 1.19     |
|                                | High (7-9)         | 33<br>(20.6)        | 84<br>(52.5)       | +30.0   | 5.92*    |

\*Significant at 0.05 level

**Table 11.** Overall distributions of respondents on the basis of level of knowledge at before and after exposure to the developed instructional videos

| Type of instructional content in video | Level of knowledge | Before exposure (%) | After exposure (%) | % shift | Z test |
|--|--------------------|---------------------|--------------------|---------|--------|
| Farming practices of tomato crop       | Low ( $\leq 25$ )  | 49<br>(30.6)        | 23<br>(14.4)       | -16.3   | 3.48*  |
|  | Medium (26-50)     | 75<br>(46.9)        | 53<br>(33.1)       | -13.8   | 2.51*  |
|  | High ( $\geq 51$ ) | 36<br>(22.5)        | 84<br>(52.5)       | 30.0    | 5.54*  |

\*Significant at 0.05 level

The instructional videos utilized in the study engaged both visual and auditory senses, offering a multi-sensory learning experience to tomato growers. Few studies investigate the role of ICTs in providing production-related information. Notable exceptions include short message services delivering crop management advice and weather forecasts in India (Fafchamps and Minten 2012), integrated pest management in Ecuador (Laroche et al 2019), agronomic advice in India (Cole and Fernando 2014) and timing advice for sugarcane farm operations in Kenya (Casaburi et al 2014). Additionally, animated videos on post-harvest management in Burkina Faso (Maredia et al 2017) and insecticidal neem use in Benin (Bello-Bravo et al 2018), as well as interactive crop advisory services via mobile phones in India (Fu and Akter 2012), have been studied. These studies report varied outcomes, ranging from no effects on production and yields (Fafchamps and Minten 2012, Dzanku et al 2022) to significant changes in input and technology use (Cole and Fernando 2014).

### CONCLUSION

The study highlights the transformative potential of instructional videos in agricultural knowledge dissemination, particularly for tomato growers. The substantial increase in knowledge levels indicates that videos not only provide accessible information but also engage farmers effectively, leading to improved understanding of best practices. The results demonstrate that video-based interventions can play a critical role in bridging information gaps and improving agricultural practices among farmers. Furthermore, the findings emphasize the importance of incorporating modern communication technologies in agricultural training programs to enhance learning outcomes. Future initiatives should consider expanding the use of instructional videos across various agricultural sectors to maximize their impact on knowledge transfer and practice adoption.

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