



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(6): 717-720
Received: 24-04-2026
Accepted: 28-05-2026

Dr. Vijaya Hosamani

Assistant Professor of Agricultural Extension, Department of Soil and Agricultural Sciences, College of Horticulture, UHS, Bagalkot, Karnataka, India

Dr. DA Nithya Shree

Professor of Agricultural Extension, Department of Agricultural Extension Education, College of Agriculture, UAS Dharwad, Karnataka, India

Dr. MP Potdar

Professor and Head, Department of Agricultural Meteorology, College of Agriculture, UAS Dharwad, Karnataka, India

Dr. A Bheemappa

Retired Professor of Agricultural Extension and Registrar, UAS Dharwad, Karnataka, India

Dr. RM Hosamani

Retired Professor of Horticulture, UAS Dharwad, Karnataka, India

Corresponding Author:

Dr. Vijaya Hosamani

Assistant Professor of Agricultural Extension, Department of Soil and Agricultural Sciences, College of Horticulture, UHS, Bagalkot, Karnataka, India

Constraints and suggestions in onion production in northern dry zone of Karnataka

Vijaya Hosamani, DA Nithya Shree, MP Potdar, A Bheemappa and RM Hosamani

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i6i.5775>

Abstract

Onion (*Allium cepa*) represents a crop of significant commercial value cultivated by diverse farmer categories and constitutes an integral ingredient in most Indian households. Karnataka ranks among the foremost onion-producing states nationally, with substantial production occurring in the northern dry agroclimatic zones, where this commodity serves as a vital revenue source for agricultural communities. Despite the crop's economic significance, onion-growing regions in the northern dry zone encounter numerous production-limiting factors that adversely affect yield levels, long-term viability of production systems, and farmer income stability. This research was designed to identify and examine the specific constraints confronted by onion cultivators in the northern dry zone of Karnataka, with findings intended to assist extension workers, agricultural scientists, and policymakers in formulating evidence-based strategies for constraint mitigation. Production, economic, and social constraints were studied as three distinct categories. The Garrett ranking technique was employed to establish a constraint hierarchy. Pest infestations (mean score 76.53), declining yields (69.60), and inadequate extension support (49.60) emerged as the highest-ranked constraints within production, economic, and social categories, respectively. Survey findings indicate that farmers prioritize the development of pest-resistant varieties, government-sponsored soil conservation initiatives, and enhanced village-level advisory services as primary solutions.

Keywords: Sustainability, productivity, constraints, suggestions, onion growers

Introduction

Onion (*Allium cepa* L.) occupies a prominent position among India's commercial horticultural crops and plays a substantial role in the nation's agricultural sector. The crop finds widespread application as a culinary staple and offers considerable nutritional and therapeutic properties. As the world's second-largest onion producer, India generates significant quantities for both internal market consumption and international trade. Within India, Karnataka stands as one of the principal onion-producing regions, particularly in northern districts characterized by semi-arid climatic conditions, where the commodity constitutes a major income-generating activity for rural producers.

The northern dry zone encompasses districts including Dharwad, Gadag, Haveri, Vijayapura, and Bagalkot, offering suitable agro-ecological parameters for onion cultivation. This crop production sector provides essential employment opportunities and strengthens rural economic foundations in these administrative areas.

Paradoxically, onion production systems in this region face substantial operational challenges that constrain output levels and farmer profitability. Contemporary onion cultivation necessitates addressing questions of long-term productivity maintenance, as mounting population-driven demand, global market expansion, and associated production pressures have introduced novel challenges. Modern farming operations contend with increasingly restrictive operational boundaries stemming from climatic variability, heightened uncertainty, elevated input costs, and volatile commodity pricing. Key impediments encompass erratic precipitation patterns, water resource limitations, elevated expenses for quality seeds and soil amendments, phytosanitary challenges, deficient technical support, and restricted access to premium planting stocks. Furthermore, farmers frequently encounter severe earnings volatility, insufficient post-harvest

storage infrastructure, burdensome transportation logistics, and losses due to intermediary markups along market value chains. These cumulative pressures frequently demotivate agricultural producers and generate instability within production systems and farm incomes.

Given these circumstances, this research investigated constraint profiles among onion cultivators in Karnataka's northern dry zone. Findings were organized into three classifications—production-related, economic, and social—to comprehensively address sustainability considerations in the sector. Recognition of these constraint categories proves fundamental for formulating targeted policy measures and technical interventions that can enhance productivity, strengthen market linkages, and provide income stability. This information will support researchers, extension institutions, and government bodies in developing context-appropriate strategies that enhance resource productivity, optimize marketing efficiency, stabilize farmer earnings, and reinforce sectoral sustainability. Examining constraints experienced by onion producers in this geographic region contributes meaningfully toward advancing both sectoral profitability and long-term viability.

Materials and Methods

The investigation was carried out across three districts within the northern dry zone of Karnataka. Selection was based on a four-year historical average of area allocated to onion cultivation, with the three highest-area districts identified purposively: Bagalkote, Vijayapura, and Gadag. Within each selected district, two taluks were chosen using the same selection criterion. From each taluk, three villages were randomly selected. A total of fifteen onion producers were randomly recruited from each village, generating a district-level sample of ninety farmers and an aggregate research population of 270 respondents.

Constraint identification employed the Garrett ranking methodology. A constraint denotes any factor that restricts or circumscribes productive activities within defined parameters. Following Garrett's approach, participating farmers assigned numerical ranks to identified factors. These ordinal rankings were subsequently converted to numerical values using the transformation:

$$\text{Per cent position} = 100 (R_{ij} - 0.5) / N_j$$

where:

R_{ij} = Numerical rank assigned to the i th constraint by j th respondent

N_j = Total number of constraints ranked by j th respondent

Using standardized conversion tables, the computed percent positions were transposed into equivalent scores. Scores for each constraint were aggregated across all respondents, and mean values calculated. Constraints exhibiting higher mean values received higher importance rankings, with this methodology following the Garrett and Woodworth (1969) procedure. Respondent recommendations for addressing identified constraints were solicited during interviews. Farmer suggestions were subsequently summarized and expressed as percentages within constraint categories.

Results and Discussion

Constraints Faced by Onion Growers

Table 1 presents the constraint spectrum identified across the three selected districts. Constraints are ranked according to their mean importance scores derived from the Garrett ranking methodology.

1. Production Constraints

Within the study region, the majority of surveyed producers (mean value 76.53) identified pest pressures—specifically twister, bulb rotting, purple blotch, and thrips—as the primary production obstacle limiting sustainability, receiving rank I. Contributing factors include erratic and intense rainfall events, scarcity of certified quality seed stock, repeated onion monoculture on individual fields, and application of suboptimal cultivation methodologies.

The subsequent significant concern centered on rainfall distribution irregularity (mean value 66.75), classified as rank II. Recent climatic shifts create predictive uncertainty regarding monsoon initiation and precipitation distribution patterns. Even when meteorological forecasts prove accurate, producers face difficulty implementing adequate crop protection measures during active growth phases.

Fertilizer supply timing complications (mean value 55.91) occupied rank III. This reflects potential procedural constraints in the distribution chain for nutrients. Farmers dependent on agricultural credit systems may experience nutrient supply gaps when demand increases during peak application windows and inventory shortages occur in cooperative or commercial distribution networks. Supplementary production impediments included elevated hybrid seed expenses (52.65), agricultural labor scarcity (48.35), weed management challenges arising from erratic precipitation (43.31), and water supply inadequacy for irrigation purposes (25.81), occupying successive ranks in descending importance. Published research by Wadekar (2016)^[16], Jangwad (2018)^[4], Raut (2018)^[7], Ravi (2019)^[8], Shashidhar *et al.* (2020)^[9], Jangwad *et al.* (2021)^[5], and Shivam *et al.* (2023)^[10] documented analogous constraint patterns.

2. Economic Constraints

A substantial proportion of respondents (mean value 69.60) cited diminishing yields as the foremost economic challenge, receiving rank I classification. The respondents themselves identified multiple yield-limiting factors, including elevated pest occurrence, erratic moisture availability, and untimely input availability. Price volatility in commodity markets formed a closely associated constraint (mean value 68.30), ranking II. Farmers additionally noted that dispersed-buyer auction settings yield suboptimal price realization (mean value 53.60), ranked III. Producer strategies targeting increased absolute production volume aim to boost marketing revenues. Paradoxically, expanded supply typically depresses demand-relative valuations, resulting in marked periodic price swings. During supply surplus periods relative to demand, farmers must resort to public auction channels, inherently generating diminished returns. These observations align with research findings by Vaishnavi and Aski (2018)^[13], Shukla *et al.* (2019)^[11], and Gantayat *et al.* (2023)^[3].

3. Social Constraints

Three primary social-sector impediments emerged: limited advisory service availability (mean value 49.63, rank I), restricted access to post-harvest storage infrastructure (mean value 34.64, rank II), and minimal asset ownership among respondents (mean value 29.50, rank III). The expansion of rural populations has widened the extension worker-to-farmer ratio, potentially limiting individual farmer access to professional advisory services. While government subsidy programs for warehouse construction exist, uptake among the region's predominantly small-scale and marginal farming populations remains limited due to informational gaps and financial constraints. Findings parallel those documented by Shashidhar *et al.* (2020)^[9], Shivam *et al.* (2022)^[10], and Lagad *et al.* (2025)^[6].

Suggestions Provided by Onion Growers

A suggestion represents a proposed action or initiative offered for deliberation. In this investigation, recommendations originated from farmer practical experience and understanding of local production conditions. These farmer-generated suggestions contribute to strategic formulation of government initiatives and extension programs, particularly regarding sustainable production practices in the region. Table 2 summarizes farmer recommendations organized within the three constraint categories.

1. Suggestions Addressing Production Constraints

The largest proportion of respondents (90.74%) advocated for development and availability of pest-resistant genetic materials, followed by cultivar promotion emphasizing resilience to climatic stress (88.52%), timely availability of crop inputs including fungicides and pesticides (74.44%), accessible quality seed supplies at economical prices (72.22%), investment in mechanized weeding technology (60.74%), and subsidized access to chemical weed management products (55.56%). A smaller percentage suggested enhanced irrigation infrastructure development (20.37%).

2. Suggestions Addressing Economic Constraints

Government-coordinated soil conservation and productivity enhancement initiatives received the highest endorsement (81.48%), followed by input-cost-based price supports (70.37%), government-guaranteed remuneration pricing mechanisms (65.18%), and APMC-facilitated transportation enabling access to geographically distant marketplaces (20.37%).

3. Suggestions Addressing Social Constraints

Farmer recommendations centered on establishing routine

technical support services at the village level (35.19%), constructing decentralized storage facilities at village or community scale (24.07%), and providing subsidized resource access programs by government entities (18.89%). Supporting evidence from comparative studies by Raghavendra (2005) ^[18], Trade *et al.* (2006) ^[16], Chandrashekhara (2007) ^[2], Varadraju *et al.* (2009), Vijaykumar (2012) ^[15], Suman (2014) ^[12], Baraker (2018) ^[1], and Ravi and Patil (2019) ^[8] validate these farmer-generated recommendations.

Table 1: Constraints Identified by Onion Growers

Sl. No.	Constraints	Mean	Rank
I	Production Constraints		
1	Higher incidence of pests and diseases (twister, bulb rotting, purple blotch and thrips)	76.53	I
2	Unequal distribution of rainfall	66.75	II
3	Non availability of fertilizers in time	55.91	III
4	High cost of HYV seeds	52.65	IV
5	Non-availability of labours	48.35	V
6	Difficult to control weeds due to erratic rains fall	43.31	VI
7	Inadequate irrigation facilities	25.81	VII
II	Economic Constraints		
1	Declining onion productivity	69.60	I
2	Fluctuation in market price	68.30	II
3	Open auction sale fetches low price for onion	53.60	III

* Multiple answers obtained

Sl. No.	Constraints	Mean	Rank
4	Distant markets	31.44	IV
III	Social Constraints		
1	Inadequate advisory services	49.60	I
2	Lack of suitable storage facilities	34.64	II
3	Meagre resources possessed	29.50	III

* Multiple answers obtained

Table 2: Suggestions Provided by Onion Growers

Sl. No.	Suggestions	f (%)
I	Related to Production Aspects	
1	Disease and pest resistant seeds / varieties must be available	245 (90.74)
2	Accessibility of varieties to withstand climatic vagaries	239 (88.52)
3	Inputs availability (fertilizers, pesticides) at right time	201 (74.44)
4	Availability of quality seeds at reasonable prices	195 (72.22)
5	Need of labour-saving devices	164 (60.74)
6	Availability of suitable weedicides at subsidized rates	150 (55.56)
7	Provision for adequate irrigation facility	55 (20.37)
II	Related to Economic Aspects	
1	Initiation of Package programme from government to maintain soil health and maintain onion productivity	220 (81.48)
2	Support price based on production cost	190 (70.37)
3	Remunerative support prices should be fixed by government	176 (65.18)
4	Provision at APMC to transport onions to distant markets	55 (20.37)
III	Related to Social Aspects	
1	Timely advisory services at village level should be provided	95 (35.19)
2	Store houses at village / community level should be constructed	65 (24.07)
3	Provision of resources at subsidized rates from government	51 (18.89)

* Multiple answers obtained

Conclusion

The investigation revealed three tiers of production limitations affecting onion cultivators: pest-disease pressures, irregular precipitation timing, and delayed fertilizer distribution. Economic sector constraints centered on productivity decline, price market instability, and insufficient price discovery in auction marketing channels. Social constraints included inadequate extension reach, restricted storage amenities, and

constrained farmer asset bases. In response, farming communities prioritize three solution pathways: (i) provision of disease-tolerant breeding lines, (ii) organized government programs targeting soil fertility management and yield maintenance, and (iii) establishment of dependable grassroots technical advisory infrastructure. Implementing these farmer-identified solutions requires coordinated action among research institutions, extension services, and policy frameworks.

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