



Research Article

Constraints to wheat production in Bakolori Irrigation Scheme
Zamfara State, Nigeria

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ABSTRACT

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Due to numerous production constraints, the real yield of wheat under smallholder farmer conditions in Nigeria is poor. The current study aims to look into the constraints to wheat production in the Bakolori Irrigation Scheme. As a result, the study's objectives were to describe the socioeconomic characteristics of wheat farmers as well as to identify the constraints to wheat production in the study area. Two stages of sampling were used in the study. Eight agricultural villages were randomly chosen for the first stage, followed by a random selection of 753 wheat respondent farmers in the second stage. The study's data was gathered from primary sources via semi-structured interviews in the Bakura, Talata Mafara and Maradun Local Government Areas and evaluated using descriptive statistics. The findings found that the majority of respondents were males with little formal education and small land holdings. It also classified wheat production constraints as biotic, abiotic, and socioeconomic. With 73%, 75%, and 75% of responding farmers, respectively, the first major restrictions based on this categorization were birds, timely sowing, and timely availability of input. *kurchiya* (Dove: *Coturnix ypsilophora*), and *Hasbiya* (Pigeon: *Columba livia*) were the most generally identified bird pest by respondents as the first to invade the crop after sowing, while *Buwa* (Quarrel birds: *Galliformes. Quail*), was the most commonly identified bird during the flowering and ripening stages. This study suggests that the Central Bank of Nigeria's Anchor Borrowing Program be used to make credit loans available at the appropriate times, and be maintained, since this will encourage farmers to actively participate in wheat production.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) cultivation can be traced back to the Neolithic Revolution 10,000 years ago (Nesbitt, 1990). Tetraploid (genome AABB) (emmer) and diploid (genome AA) (einkorn) were the first cultivated types (Shewry, 2009). Several researchers have suggested that wheat originated in Turkey's south-eastern region (Dubcovsky & Dvorak, 2007; Nesbitt, 1998). The A genomes of hexaploidy and tetraploid wheat were related to the cultivated einkorn genome and the wild genome. Contrarily, the S genome gave rise to the Sitopsis section of *Aegilops* with *Ae*, which was generated from the B genome of hexaploidy and tetraploid wheat (Feldma *et al.*, 1995). Wheat is the world's second-most significant cereal crop for food security, after rice (Ahmad *et al.*, 2021; Joshi *et al.*, 2007). In the contemporary human diet, wheat is still the primary ingredient on a worldwide basis (Shiferaw *et al.*, 2011).

In most nations around the world, wheat greatly supports the creation of jobs, food security, and the alleviation of poverty (Edwin *et al.*, 2020). At the worldwide level, wheat contributes roughly 21% of the protein and 19% of the calories required for daily human meals (Braun *et al.*, 2010). In Africa, wheat is a staple cereal that accounts for 30% of food in the western and central continents and more than 60% of food calories in sub-Saharan Africa (Edwin *et al.*, 2020; Gitu, 2006). Wheat leftovers are used in feed mills to create livestock feed (Ahmed, 2014). Wheat is the primary food source for more than 35% of the world's population, which is produced globally on an annual basis by more than 713 million tons (Haruna *et al.*, 2017; Shabanden, 2022). Due to strong demand and its importance in ensuring food security, since 1961, the global production of wheat has increased by an average of 21.8% annually (FAOSTAT, 2019; Pardey, 2011).

Sub-Saharan Africa (SSA) produced 7.5 million tons of wheat in an area of 2.9 million hectares, accounting for 40 and 1.4% of the wheat produced in Africa and globally, respectively (FAO, 2017). Due to pressure from a growing global population, dietary adjustments, and lifestyle changes, the production of wheat is projected to be in high demand shortly. This presents a significant challenge to agriculture, particularly in poorer nations (Edwin *et al.*, 2020; Minot *et al.*, 2015). Nigeria is among the most important wheat-producing countries in SSA (Tadesse *et al.*, 2018). In Nigeria, wheat is a crop that is significant for both industry and domestic use. Almost all homes, hotels, and restaurants use it in some capacity (Falola *et al.*, 2017). Nigeria is Africa's most populous country (Falola *et al.*, 2017; Haruna *et al.*, 2017). With the world's population growing and food security becoming more vital, boosting wheat yield potential in underdeveloped countries remains a top concern. High-production irrigated areas will continue to play an important role in achieving this goal (Duveiller *et al.*, 2007).

For the past 15 years, wheat has been Nigeria's most imported commodity (Haruna *et al.*, 2017). Despite multiple bans by the current and previous administrations, wheat importation is always rising due to the enormous demand for wheat in Nigeria and the low production rate as a result of various constraints (Falola *et al.*, 2017). According to Sall *et al.* (2019), there has been a 5% positive growth in recent years. According to Chidebe (2021), 4.9 million tons of wheat were anticipated to be imported in that year. Nigeria has relied on wheat imports to meet domestic demand, and it ranks 13th among global wheat importers, with 4 million metric tons imported in 2015. Because of increased demand, its per capita wheat consumption is expected to be 20kg in 2011.

(FAOSTSAT, 2014; Falola, *et al.*, 2017; Wuletaw, *et al.*, 2018). Due to different production constraints, the real yield under smallholder farmer settings is low (Falola, *et al.*, 2017). A thorough understanding of the constraints affecting wheat production in the Bakolori Irrigation Scheme is necessary to develop sound policies to close the gap between domestic demand and supply in Nigeria and make the country self-sufficient in wheat production. However, various obstacles must be solved to achieve the desired aim; this can be accomplished when the challenges affecting smallholder farmers are adequately addressed (Haruna, *et al.*, 2017; Falola, *et al.*, 2017).

There is still a sizable gap between domestic demand and supply of wheat in the nation, despite the Federal Government of Nigeria's efforts to make Nigeria self-sufficient in wheat production through the introduction of numerous agricultural programs and the establishment of numerous institutions aimed at fostering interest in local wheat production from the 1970s to the present. This is because the problems faced by smallholder farmers are not being addressed at the bottom-up level in wheat production areas. To the best of our knowledge, no prior research has considered the key limitations affecting wheat production in the Bakolori Irrigation Scheme, except Falola *et al.* (2017), who concentrated on the factors that determine the commercial production of wheat in Nigeria: A case study of

Bakura Local Government Area, Zamfara State. This is not the complete Bakolori Irrigation Scheme, but only a portion of it. There has been no recent research on the key production restrictions contributing to low wheat productivity in the entire Bakolori Irrigation scheme.

MATERIALS AND METHOD

Study Area

The area experiences a tropical wet and dry climate. In which distinct wet and dry seasons were observed it is designated as *Aw* by Koppen (Danjuma and Abubakar, 2017), the area's low temperatures throughout the winter months of November to February encourage the growth of wheat. This backed with the assertion made by (Mukherjee *et al.* (2019) and Karuku, (2018) that wheat needed a period of time at a low temperature of 15 to 20°C. The Sokoto Rima River Basin Development Authority oversees the Bakolori irrigation project, one of the nation's oldest, refer to figure 2. The BIS catchment area includes three local government areas in Zamfara state: Maradun, Talata Mafara, and Bakura refer to figure 1. The irrigation area includes 23,000 hectares of irrigable land. The dam has 450 million cubic meters of storage capacity (Yahaya, 2002).

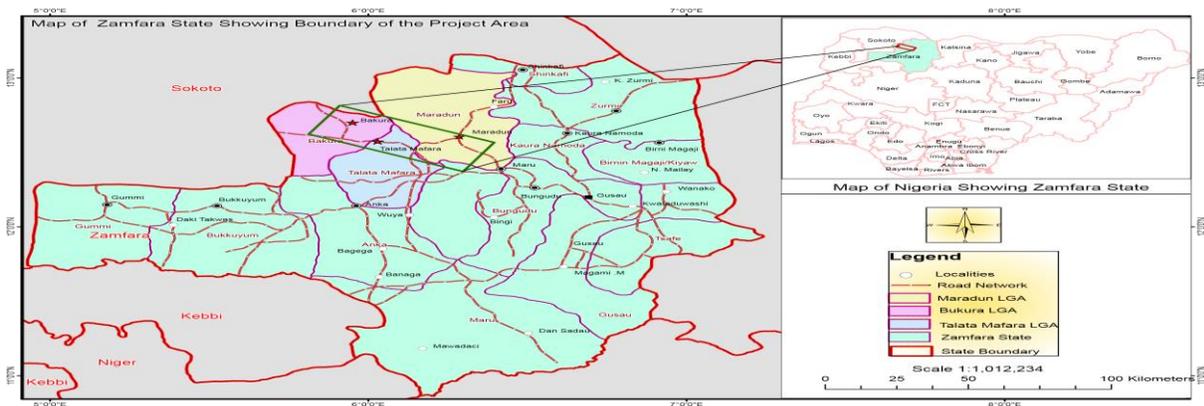


Figure 1: Map of Zamfara State Showing Boundary of the Project Area
 Source: ESIA (2013) Bakolori Irrigation Scheme Rehabilitation Project

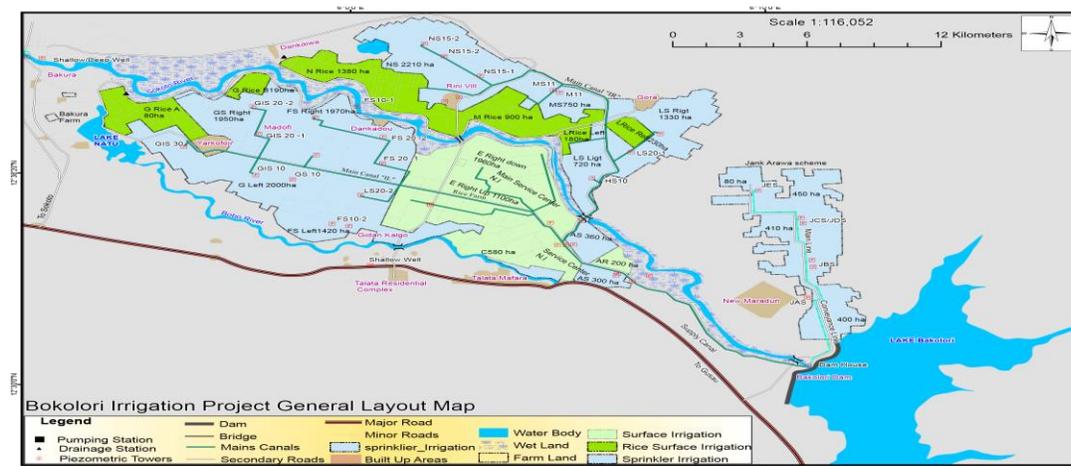


Figure 2: Bakolori Irrigation Scheme
 Source: ESIA (2013) Bakolori Irrigation Scheme Rehabilitation Project

METHODOLOGY

Sampling procedures

A purposive and random sample of farmers was used in a multi-stage sampling procedure. The technique allowed a representative sample of wheat producers in the research areas to be chosen (Falola *et al.*, 2017). The study's data was mainly gathered from primary sources via semi-

structured interviews. The sampling frame of 1527 consisted of the wheat farming households in the study area. Two stages of sampling were used in the investigation. In the first stage, eight farming communities were chosen at random in the ratios of 4:3:1 from the three LGAs of Talata Mafara, Bakura, and Maradun. In the second phase,

753 households from various communities that cultivate wheat were chosen at random. The minimal sample size was determined using the sample size table.

The semi-structured interview covers topics such as household demographics and the constraints affecting wheat production in the research area under the researcher's supervision, the Semi structural interview was pre-tested on non-sample respondents, and required changes were made. Finally, following the necessary revisions and adjustments based on the pre-test, the formal survey was conducted on the

sampled farmers in the months of January to march 2022.

Data Analysis

Descriptive statistics in % were employed to investigate the socioeconomic characteristics of respondents and the constraints to wheat production in the research areas, using the formula for computing percentage i.e., $\left(\frac{x}{total\ population}\right) * 100$, where X represent the number of respondents for a particular variable.

Table 1: Sampling Design for the Study

Local Government	Communities	No. of wheat farming households	No. of households selected	Percentage
	Mafara	819	260	34
Talata Mafara	Ware Danste	31	28	4
	Maitako Sabon Gari	10	10	1
	Tungar Danga	51	44	6
	Birnin Tudu	52	47	6
Bakura	Rini	92	80	11
	Yarkofoji	251	152	20
Maradun	Goran Namaye	221	132	18
Total		1527	753	100

Source: Field survey, 2022

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Farming Households

Table 2: depicts the socioeconomic characteristics of household farmers which include gender, age, married status, educational status, farm size, and yield per hectare. The

male population was 93%, which was slightly higher than the reported figure of 72.9% (Kassa, 2008). This mirrored the fact that men dominated the agricultural system and decision-making in the study areas as reported by (Falola, *et al.*, 2017). Furthermore, the majority of respondents (78%) were between the ages of 31 and 50, and they were seen as the

most active; This is in line with the findings of Nigus (2022) who identified 30-50-year old as the most active group farming wheat in the highlands of Eastern Ethiopia. Only 4% of those interviewed were between the ages of 20 and 30. The majority of respondents (87%), but only a few percent, were single, divorced, or widowed; this result corresponded to 87.4% of male households in wheat production areas of Bakura Local Government in Zamfara State (Falola, *et al.*, 2017). As for informal and nonformal education, a high share had Islamic and adult education. (66%) Only 26% had a

formal education, which included primary, secondary, and postsecondary schooling.

Due to the increasing population and excessive cost of land and leasing, 75% of respondents owned ≤ 3 hectares (ha) because their income level is low to afford it. This analysis supports the average land size of 0.52 and 0.56 ha per household in East and West Hararghe, respectively (Nigus, *et al.*, 2022). Due to biotic, abiotic, and socioeconomic constraints, only 9% of respondents produced within the Central Bank of Nigeria's stipulated estimated output of 2 to 3 tons per hectare

Table 2: Socio-Economic Characteristics of Respondents

Variables	Category	Frequency	Percentage
Gender	Male	704	93
	Female	49	7
Age	20-30	29	4
	31-40	228	30
	41-50	365	48
	51-60	89	12
	>60	42	6
Marital Status	Single	70	9
	Divorced	18	2
	Widowed	20	3
	Married	645	86
Educational Status	Informal	498	66
	Nonformal	72	10
	Formal	183	26
Farm size(ha)	≤ 3	458	75
	4-6	72	13
	7-9	37	7
	≥ 10	15	5
Yield per hectare(kg)	≥ 100	201	27
	101-500	320	42
	501-1000	128	17
	1001-1500	37	5
	1501-2000	42	6
	above 2000	25	3

Source: Field survey, 2022.

Constraints to Wheat Production by the Respondent Farmers

The production constraints of wheat identified by respondent farmers in the study area were categorized into three major groups biotic,

abiotic and socio-economic. The results were tabulated with multiple responses.

Biotic Constraints to wheat production by the respondents

Table 3: Biotic Constrains to wheat production by the respondents

Variables	Frequency	Percentage	Ranking
Birds	547	73	1st
Rodents	467	62	2nd
Weeds	355	47	3 rd
Insects	265	35	4 th
Warms	187	25	5 th

Table 3 revealed the biotic constraints reported by the respondents in order of importance: birds, rodents, weeds and insects.

Note: * Multiple responses were allowed; Source: Field survey 2022.

Among the biological constraints, birds accounted for 73%. *kurchiya* (Dove *Coturnix ypsilophora*), and *Hasbiya* (Pigeon: (*Columba livia*)) were recognized by respondents as the first to invade the crop after sowing and inflict harm during the germination and seedling stages. They also remove developing young seedlings. *Buwa* (Quarrel birds: *Galliformes. Quail*) were the most destructive throughout the flowering and ripening periods. Farmers in the majority of the study area also stated that birds cause economic losses in agriculture by destroying crops during the sowing, seedling, and ripening stages. They went on to claim that the devastation was worst in the morning, between 6:00 a.m. and 10:00 a.m., and in the evening, between 4:00 p.m. and 6:00 p.m. This supports the findings of Kale et al. (2012), who discovered that the Pigeon (*Columba livia*) and House crow (*Corvus spendens*) were the first to invade the crop after sowing and cause damage during the germination and seedling stages.

According to several studies, birds are known to drastically reduce crop yields by destroying them. They also cause losses in agriculture by destroying crops during the sowing, seedling, and ripening stages, which causes economic

losses for the farming community (Kale, 2014; Patel 2014). The *pigeon Columba livia*, *rose-ringed parakeet Psittacula krameri*, and house crow *Corvus spendens* were identified as the major bird pests of major cereal crops such as rice, millet, and wheat during the milky and dough stage, supporting the findings of Patel (2016) who researched control of bird pests to damage millet crops in Semi-arid Zone of Northern Gujarat, India.

Rodents were considered the second most damaging biological constraints in some study locations, particularly where irrigation water was one of the most significant abiotic challenges, such as Gora Namaye, Tungar Miya, and Ware Dantse, with 62%. The most destructive rodents identified were the *Kusa* (rat: *Rattus rattus*) and *Kulba* (skink: *Scincidae*), and their destruction was severe when the wheat was in the flowering and ripening stages, especially when there was no moisture in the farms. It was also discovered that the damage was particularly severe at night. Early research by Ismaila *et al.* (2010) reported that rats, termites, locusts, and birds as the principal pests substantially damage the grain crop productivity in Nigeria,

Weeds, which ranked third with 47% of respondents, were regarded as one of the study's moderate biological constraints because farmers in the study area are using herbicides for weed control. An earlier study on the significance of using herbicides for weed management demonstrated 87.2 to 90.3% effectiveness (Khan, *et al.*, 2011). Chatrath *et al.* (2007) reported that the current use of herbicides will result in herbicide-resistant weeds, underground water contamination, and several health-related cases. He also supported the idea of using biological weed control by using plant pathogens, particularly in the form of mycoherbicide. Weeds compete with the crop for space, moisture, nutrients, and light, resulting in severe yield losses. This study corroborated the prior research like Khan *et al.* (2011) and Shad (1987) recognized weed as the biggest concern for wheat production since it competes for nutrients, light, space and moisture with the crop thus, create substantial losses in yield. This coincided with the finding of Nayyar *et al.* (1995) that a reduced yield of wheat of 25-30% occurred in Pakistan due to weed infestation.

Respondents recognized *Nanare*(*Oryza barthii* *O. perennis*), *Sabe*(*Echinochloa colonum*), *Harkiya*(*Digitaria debilis*), *Girgiri*(*Sphenostylis stenocarpa*), *Balasaya*(*commeline fonkolali*), and *Karangiya*(*cenchrus cilarris*) as common weeds found everywhere, whereas *Danye Rakumma*(*Arachis hypogaea*) and *Sabulun Salo*(*Zornia glochidiata*) were discovered in recently rehabilitated areas of (Ware Dantse, Tungar Miya) and Rini respectively. *Avena fatua*, *Phalaris minor*, *Cirsium arvense*, *Convolvulus arvensis*, *Ammi*

visnaga, *Chenopodium album*, *Carthamus oxycantha*, and *Euphorbia helioscopia* were discovered to compete with wheat crops in Khyber Pakhtunkhwa province (Hassan *et al.*, 2003). With other prior findings, the research locations have very diverse and variable weed species. This supported some researchers' conclusions about the kinds of weeds that have an impact on the growth of cereal crops like millet. According to Chaudhary *et al.* (2016) and Arslan *et al.* (2018), the type of weeds differs from location to location depending on the type of soil, the time of year, and the environment in which the crop is cultivated.

Weeds were found to be a significant threat to wheat productivity in earlier studies, resulting in significant yield losses (Shad, 1987; Shewry, 2009; Wuletaw, *et al.*, 2018). Respondent further testified that pesticide use decreases weeds in wheat and increases productivity. An early study by Duke and Lydon (1993) found that using herbicides resulted in 87.2 to 90.3% weed control and a 19.4 to 20.9% increase in wheat yield.

Abiotic Constraints to wheat production by the respondent Farmers

Table 4 depicted the key abiotic restrictions at various intensities across the study areas. Farmers identified insufficient access to irrigation water, timely sowing, soil fertility level, and access to land as key abiotic constraints. With 75% of responders, timely sowing was identified as the most significant limitation. Delay in planting wheat has many effects including excess weed, pest and insect attacks. According to Nigus *et al.* (2021), wheat leaf rust disease (*P. triticina* Eriks) is mostly treated by cultural methods such as early planting to avoid production losses.

Table 4: Abiotic Constrains to wheat production by the respondent farmers

Variables	Frequency	Percentage	Ranking
Timely sowing	562	75	1st
Poor access to irrigation water	462	61	2nd
Access to Land	411	55	3rd
Fertility status of the soil	345	46	4th

Note: * Multiple responses were allowed; Source: Field survey 2022

Respondent farmers reported that the best time for wheat sowing is between November 15 and December 15, with any delay causing significant grain quality and yield reductions due to reduced duration of development stages, adverse biochemical and physiological changes, lower biomass, and early leaf senescence. This was further supported by other findings, such as the report of Tadesse *et al.* (2018) showing that delayed sowing can significantly reduce grain quality and yield. Additionally, Ali *et al.* (2017) found that wheat is heat-sensitive and that any delay in seeding can easily damage the yield and quality of the crop. Furthermore, supported by Yami *et al.* (2012), who verified that Ethiopia's low yield was caused by terminal drought stress brought on by delayed wheat sowing. According to Nigus (2022), one of the main cultural practices that helped Ethiopia handle its difficulties with wheat rust disease was the early planting of wheat.

Poor access to irrigation water was recognized as the second major limitation of wheat output in the research area, with farmers using two types of irrigation: surface irrigation and tube well. Surface irrigation was employed in areas assigned under the Bakolori Irrigation Scheme, mainly in Mafara, Ware Dantse, Maitako, and Tungal Danga; however, farmers in Rini, Yarkofoji, and Gora Namaye water their farms using a combination of methods. Respondent farmers stated that insufficient irrigation water, combined with low subsurface water, was the most detrimental to all stages of wheat production. This supports the findings of

Tadesse *et al.* (2018), who discovered that the most significant biotic constraints in the irrigated settings of Chad, Senegal, Somalia, Sudan, Malawi, Mali, Nigeria, Zambia and Zimbabwe are heat and water lock. According to this study, water is becoming scarce at the early stages of wheat production due to high demand, especially in places where production is dependent on irrigation.

Irrigation with canals provides a higher potential yield because of the additional potassium in the water, as demonstrated by an earlier study by Tahir *et al.* (2003) that found that canal water irrigation increased wheat yield compared to other types of irrigation due to its high potassium content. Similar findings can be found (Memon, 2017), Underground water that is pumped through pipes is of lower quality than canal water (Ahmad *et al.*, 2021). So, based on our research, farmers who had access to canal water for irrigation produced more crops than those who were solely dependent on underground water. It concurred with Ahmad *et al.* (2021) report that farmers whose crops were entirely dependent on underground water had lower crop yields than those who had access to canal water for irrigation. This was further backed up by the findings of Tahir *et al.* (2003), who found that farmers' yields are always affected by their inability to pay the high energy costs associated with pumping water. Farmers' remarks indicate that a constantly deteriorating worry for wheat production is a scarcity of irrigation water. A decline in yield was identified by Ahmad *et al.* (2021) among the 9% of the farmer in Cotton-

Wheat Punjab (Pakistan) who had no canal water available and were dependent on the tube well water.

Respondents ranked soil fertility and access to land as the fourth and fifth most important abiotic constraints to wheat production, with 46% and 55%, respectively. This was in agreement with (Nigus *et al.*, 2022), who stated that the fourth and fifth production constraints for wheat in the research areas were high input costs (including land) and a lack of inorganic fertilizers as a result of poor soil fertility. This finding was similar to that of Jat *et al.* (2011), who found that areas with less levelled land were absorbed with low crop yields and soil fertility, and it was also supported by a recent finding by Ahmad *et al.* (2021), who found that 65% of respondents had poor yields because the farm land's fertility status was not good.

According to the respondents, restricted availability increased land prices, and soil fertility status hampered subsistence farmers from realizing their wheat production potential. As a result, its productivity remains very low, owing in part to poor accessibility, availability, and affordability. This is consistent with recent research by Nigus *et al.* (2022), which revealed

that low land productivity and limited access to land were identified as important constraints for 92.9 and 90.4% of smallholder farmers in East- and West-Hararghe, respectively. This was in line with Tesfaye & Seifu's (2016), conclusions that small farm size, a relatively small and fragmented land system, and severe population pressure are the constraints to wheat production in Ethiopia's eastern areas.

Socio-Economic Constrains to wheat production by the respondents

Table 5 ranked the main socioeconomic restrictions impacting wheat output in the research area in terms of importance. The first was timely availability of input, which was cited by 75% of respondents. They indicated that timely availability of input was the most critical factor in all phases of wheat production. It was discovered that providing input at the appropriate time reduces the effects of numerous biotic and abiotic constraints like weeds pathogens, and excessive heat.

Table 5: Socio-Economic Constrains to wheat production by the respondents

Variables	Frequency	Percentage	Ranking
Timely availability of input	567	75	1 st
High cost of input	467	62	2 nd
Low output price	254	34	3 rd
High cost of labor	231	31	4 th
Pre and postharvest cost	142	19	5 th
Security	111	15	6 th

Note: * Multiple responses were allowed; Source: Field survey, 2022.

The response also revealed that most farmers in the research area had difficulty obtaining all necessary input for growing wheat before the Central Bank of Nigeria's (CBN, 2021) intervention through the Anchor borrower. Although the CBN intervention to resolve

challenges in wheat production by making inputs available to farmers was actualized, there was an unnecessarily long wait for the disbursement of the CBN credit package due to logistical issues. According to recent research such as Ademe *et al.* (2017) and Nigus *et al.*

(2022), access to inputs is critical for acquiring proper seed, market access, technical expertise, herbicide, and fertilizer, all of which boost production.

It was also discovered that respondents considered input costs to be the second most critical constraint of wheat production. Although it was widely reported that input prices had surged, wheat growers have been unable to meet their high production costs. Farmers in the research area lack the financial resources to obtain the necessary inputs, although being aware of their benefits. This supported the findings of Nigus *et al.* (2022) and Falola *et al.* (2017), who observed that only a few farmers had the financial resources to apply all necessary inputs at the appropriate time. It was also agreed with Haruna *et al.*, (2017), who observed that the cost of fertilizer and pesticide inputs were too expensive for smallholder farmers, and the low yield on their small landholdings could not balance production expenses, discouraging investment in input procurement.

According to the perspectives of the farmers who responded, the third most significant constraint to wheat production in the research area was low output price (34%). They discovered that the local market determines the price of all crop growth, including wheat. Those who received the anchor borrower loan from CBN were yet to assert the actual price that the Federal Government of Nigeria will fix per bag of 100 kg. They also expressed that with the current price of input coupled with low output price wheat production in the area is not sustainable. Several previous studies, like Chawarika (2016) and Haruna *et al.* (2017), found that the cost of inputs was too high for smallholder farmers, and the low price of output did not offset the production expenses, discouraging investment in wheat cultivation. When farmers compared the high cost of production and the low selling price, many of

them disengaged from farming activities, according to Edwin *et al.* (2020), a study conducted in Kenya. This study revealed the negative impact of the low output price of wheat that lead to a major constraint.

31%, of respondents, judged high labour costs to be one of the restrictions influencing the wheat output. Despite the communal farming system among rural people, the majority of farmers in Mafara, Yarkofoji, and Goran Namaye employed field labourers throughout the stages of wheat production due to insufficient machinery and high herbicide costs. High demand for human work, combined with a scarcity of labourers, results in a steady increase in labour cost, affecting wheat production. It was also found that all wheat growers harvested their wheat manually because the Bakolori Irrigation Scheme does not have a single combine harvester.

The sixth constraint in wheat production was considered to be pre and postharvest costs. It was discovered that poor harvesting, threshing machines, and the presence of thumb grasses (*Arachis hypogaea*) in areas of Ware Dantse and Tungar Danga were among the causes of high harvesting costs. The post-harvest loss of food crops is a global problem for attaining sustainable development goals including ending hunger, according to (FAO *et al.*, 2018). Numerous studies measured the extent of postharvest loss in vegetables, tubers, and cereals. According to FOA (2013), losses of starchy roots at various points in the supply chain are in the top ten global food losses. Reducing postharvest losses is essential for maintaining future global food security, according to (Aulakh *et al.*, 2013). This supported the idea of Ahmad *et al.* (2021), who stated that proper threshing, storage, and preservation are necessary to avoid the pre- and post-harvest costs.

The last barrier highlighted by respondents was a security issue affecting wheat

production. In addition, kidnapers' and bandits' activities in Northwestern Nigeria, where there is a comparative advantage for wheat production, have made the situation worse recently by increasing security threats and attacking farmers and their crops. As a result, farmers have been reluctant to work during the day and find it impossible to irrigate at night, according to respondents Goran Namaye, Rini, and Birnin Tudu. This was in line with the findings of Haruna *et al.* (2017), who asserted that Boko Haram's activities in Eastern Nigeria caused the displacement of farmers and had an impact on the region's wheat output. A significant yield decrease of 20% from North Eastern Nigeria was reported by the national wheat production in 2016 as a result of the Boko Haram situation, showing the negative impacts on wheat production (Adelaja & George, 2019).

CONCLUSION

According to the findings, the majority of respondents had informal and nonformal education and are active wheat farmers between the ages of 31 and 50. The key constraints were identified as biological, abiotic, and socioeconomic. Birds (73%), weeds (47%), rats (62%), insects (35%), and worms (25%) were also identified as biotic limitations. The most frequent weeds found throughout were *Nanare*(*Oryza barthii* *O. perennis*), *Sabe*(*Echinochloa colonum*), *Harkiya*(*Digitaria debilis*), *Girgiri*(*Sphenostylis stenocarpa*),

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This study thus recommends that the availability of credit loans at the appropriate time, through the Anchor Borrowing Program of the Central Bank of Nigeria, be maintained, since this will encourage farmers to actively participate in wheat production. Adequate security is essential to give farmers confidence and allow them to fully engage in farming activities. This might be accomplished by providing experienced military personnel, hardware, and the participation of local vigilantes.

It has been suggested that adequate pest and weed control measures through biological, physical and cultural methods should be put in place to reduce the major wheat constraints, this could be achieved through the introduction of wheat varieties with high disease resistance and reduce the use of chemical like herbicide that leads to economic, environmental and health risks. Biological control has been considered as the most socially acceptable, economically sustainable, practically possible and environmental friendly.

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