

PRODUCTION AND TRADE SCENARIO OF MAJOR UNDERUTILIZED CROPS OF NEPAL

Damodar Gautam^{*.1}, Bhuwan Subedi²

¹National Maize Research Program (NMRP), Rampur, Chitwan, Nepal

²Agriculture and Forestry University (AFU), Rampur, Chitwan, Nepal

*Corresponding author

Email: gautam.damodar.np@gmail.com

Abstract. *In Nepal, underutilized crops are the crop species which have high potential for food, nutrition, dietary and culinary diversification but are less prioritized in formal research, education, extension and development. Analysis of the trend of production and trade helps to formulate and prioritize governing policies for the development of the underutilized crops in Nepal. Analyzing this need, This study aims to reveal the production and trade scenario of major underutilized crops of Nepal; mainly Finger millet, Buckwheat and Barley over the years. Secondary data collected from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), Ministry of Agriculture and Livestock Development (MoALD), Department of Customs and relevant articles were used for the study and to analyze the ongoing trend, simple linear regression model was used. Collected and analyzed data revealed that, production area of millet is decreasing. However, the production quantity is increasing mainly because of the increased productivity. Though the production is increasing, the import of millet is also high. Increased consumption of local liquor products made from millet followed by diversified food product consumption have seems to conducted the increased demand. The production area of buckwheat found steady over a decade, however, the production and productivity is increasing. The production area and productivity of barley is decreasing while the import of barley is increasing from 2013/14 with the sudden fall in 2019/20. The sudden decrease in import in 2019/20 was due to trade restriction due to Covid situation. But now the demand of these underutilized crops is increasing year after year, and this will continue in forthcoming years also, mainly because of raise in awareness about the health and nutritional benefits. To reduce the ballooning trade deficit of these crops in near future, along with productivity, effective area expansion policies and programs should be formulated and implemented from all three tiers of government.*

Keywords: *Underutilized crops; production; productivity; trade*

1. Introduction

Underutilized crops are those crops that have received little attention or have been ignored entirely by agricultural researchers, plant breeders and policy makers (Li & Siddique, 2019). These are the indigenous crop species which are still used within the local, national or even international communities, though cared less, have the potential to contribute food security, nutrition, dietary and culinary diversification, health and income generation (Chandra, Naresh, Thenua, & Geethanjali, 2020). They are also known as neglected, minor, lost, promising, alternative, and traditional crops. Only about 30 crop species provides more than 95 % of the world's food energy whereas, over 7000 crop species have been used for food that are domesticated either fully or partially (Williams & Haq, 2002). These crops have underexploited potential for contributing to

food security, nutrition, health, income generation and environmental services (Durst & Bayasgalanbat, 2014). Underutilized crops are indigenous ancient crop species which are domesticated and have been used for centuries for their food, fiber, fodder, oil, or medicinal properties within the local, national or international communities, but have been reduced in importance over the time due to particular supply and use constraints. It has the potential to contribute significantly to the food sources than they currently do in the daily basis (Adhikari, Hussain & Rasul, 2017). Farmers prefer the crop that produce high yield in low input, that can tolerate stresses, need less care, can be grown in diverse agro-climatic condition, possess balance nutrients and have good market prices (Luitel, Siwakoti, Jha, Jha, & Krakauer, 2017). Production of major crops such as rice, maize and wheat require a fertile, irrigated land and good management practices which cannot be available in all areas. This problem can be solved by agricultural simplification i.e. the area which are less fertile, poor soil condition, rain-fed and with average or poor management practices, underutilized crops can be grown in those areas with comparative advantages for growing in wider ranges of habitats, simple cultivation practices, easier storability, nutritional properties, taste etc. (Padulosi, Hodgkin, Williams & Haq, 2002). It can be named as Future Smart Food because they are nutritionally rich, climate resilient, economically viable and locally adaptable (FAO, 2018). These crops are called underutilized crops because their distribution, biology, cultivation and uses are poorly documented. They have weak or no formal seed supply systems, produced in traditional production systems with little or no external inputs and they receive little attention from research, extension services, policy and decision makers, donors, technology providers and consumers.

In Nepal, underutilized crops are the crop species which are not included in formal research, education, and development. But these crops have high potential for food, nutrition, dietary and culinary diversification, health, income generation and adapted well in marginal soils and harsh climates of Nepal (Joshi, Shrestha, Gauchan, & Shrestha, 2020). In the year 2018 the production area under Millet, Barley and Buckwheat was only 8.64 % and production was only 3.33 % of the total area with the productivity only 1.19 ton ha⁻¹. Similar trend was seen in 2019 as well with the area, production and productivity of 8.69 %, 3.32 % and 1.20 ton ha⁻¹ (MoALD, 2020).

Despite so many benefits of underutilized crops the production area, production and productivity are not increasing because of many challenges. These crops are labor intensive as compared from transplanting, weeding, harvesting, threshing, and grinding as compared to other cereals. Moreover, the crop is considered as the “low status food” or the “food of marginalized communities”. In addition, there is lack of awareness about the nutritional composition and health benefits of these crops to the people. Finally, it is also neglected by the research and development agencies (Gyawali, 2021). Moreover, Nepal faces instability in export and import of these

underutilized crops. Instability is the result of fluctuations in demand and supply or other economic and non-economic factors. Land fragmentation, lack of irrigation, climate based agricultural farming and increase in population of are the reasons for export and import instability (Devkota, 2004). To meet these challenges, human and institutional capacities for research and development should be enhanced, timely availability of high quality seeds should be ensured, locally adaptable mechanization tools should be made, policy environment should be amicable, value chain development to meet the market demand and public awareness should be done (FAO, 2008). Realizing all these persisting issues, this study aims to analyze the ongoing and future possible trend on area, production, productivity, import and export of major underutilized crops of Nepal. Understanding of ongoing trend and the contribution of those crops in nutrition, food security and economy, helps for the policy maker to prioritize the most potential crops in research and development.

2. Methods

This study is mainly based on secondary data that were collected from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), Agriculture Information and Communication Center (AICC), Department of Customs and relevant articles. The data analysis was done using 10 years of data from 2010/11 to 2019/20 on area, production and yield and eight years of data of import and export on crop barley, buckwheat, and millet. For the trend analysis, simple linear regression models were used. This study also uses trend lines, bar graphs and line graphs to describe the real status of production, productivity, cultivation area, import and export scenario of barley, buckwheat and millet in Nepal and status of the world.

3. Results and Discussion

3.1. Scenario of agriculture in Nepal

Agricultural sector (Agriculture, Livestock, Fishery and Forestry) shares 22.96% of the national GDP (MoALD, 2021). Among these sectors Agriculture shares the highest percentage (15.44), which is followed by Livestock (5.58), Forestry (1.56) and Fishery (0.37) respectively (Figure 1). This significant share on GDP of the country has multiplier effect on creating jobs and in supporting other sectors that in contribute to the GDP. The agriculture sector contributes to employment, income, food security and poverty reduction, especially in rural areas, is quiet. Agriculture is also an important sector for poverty reduction and shared prosperity. Between 2003/04 and 2010/11 most of the poverty reduction occurred in rural areas and was driven by rising agriculture incomes (ADB, 2017). Despite the potential multidimensional contribution, agriculture sector in Nepal is one of the most volatile and fragile sector. Over the years, Increase in agricultural income has resulted from gains in prices, not yields. Most of the Nepalese farmers

are diversifying away from grain staples to fruits, vegetables, and cash crops, but the trend cannot be seen on a larger scale. As a result, agricultural productivity growth and its contributions for national GDP has been one of the lowest in the region. We can see the decreasing trend on contribution of agricultural value-added products to the total value-added products (MoALD, 2021). In Nepal, low level of technical change and technical efficiency are the principle factor inhibiting growth in agricultural productivity especially in the Terai region which is also considered as the grain basket of Nepal (Cosic, Dahal & Kitzmuller, 2017). The total factor productivity (TFP) growth rate for the period 1981– 2013 was only 0.06 percent per year, which is the lowest in South Asia region (Anik, Rahman & Sarkar, 2017). Government prioritization for the development of agricultural sector is found as relatively weak as reflected by only 10.6 percent of expenditure on agricultural total outlays and allocation of below 3 percent of total budget in consecutive fiscal years for central federal agriculture ministry (MoF, 2020). Agricultural land is decreasing day by day mainly due to increased urbanization. Cereals, which cover most of the cultivated land in the country and have potential impact on AGDP, have lower yields in Nepal than in neighboring countries.

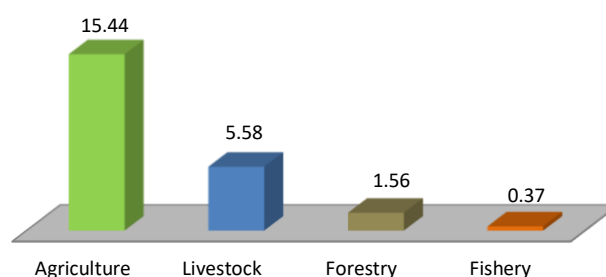


Figure 1. Share of Agriculture, Livestock, Forestry and Fishery sectors in National GDP (%)
Source: (MoALD, 2021)

3.2. Global scenario of underutilized crop (Millet, buckwheat and barley)

The trend line depicts that the area under barley, millet and buckwheat decreased slightly. The production area under barley, millet and buckwheat were 54.6, 33.8 and 2.02 million ha in 2009, and were 51.1, 31.6 and 1.6 million ha in 2019 respectively. Similarly, the trend line depicts that the production of barley and millet increased slightly (from 150.9 and 25.9 million in 2009 tons to 158.9 and 2.8 million tons in 2019 respectively). However, the production of buckwheat decreased slightly from 1.8 million tons in 2009 to 1.61 million tons in 2019. The productivity of barley, millet and buckwheat was increased slightly from 2.76, 0.77 and 0.89 tons ha⁻¹ in 2009 to 3.11, 0.90 and 0.96 tons ha⁻¹ in 2019.

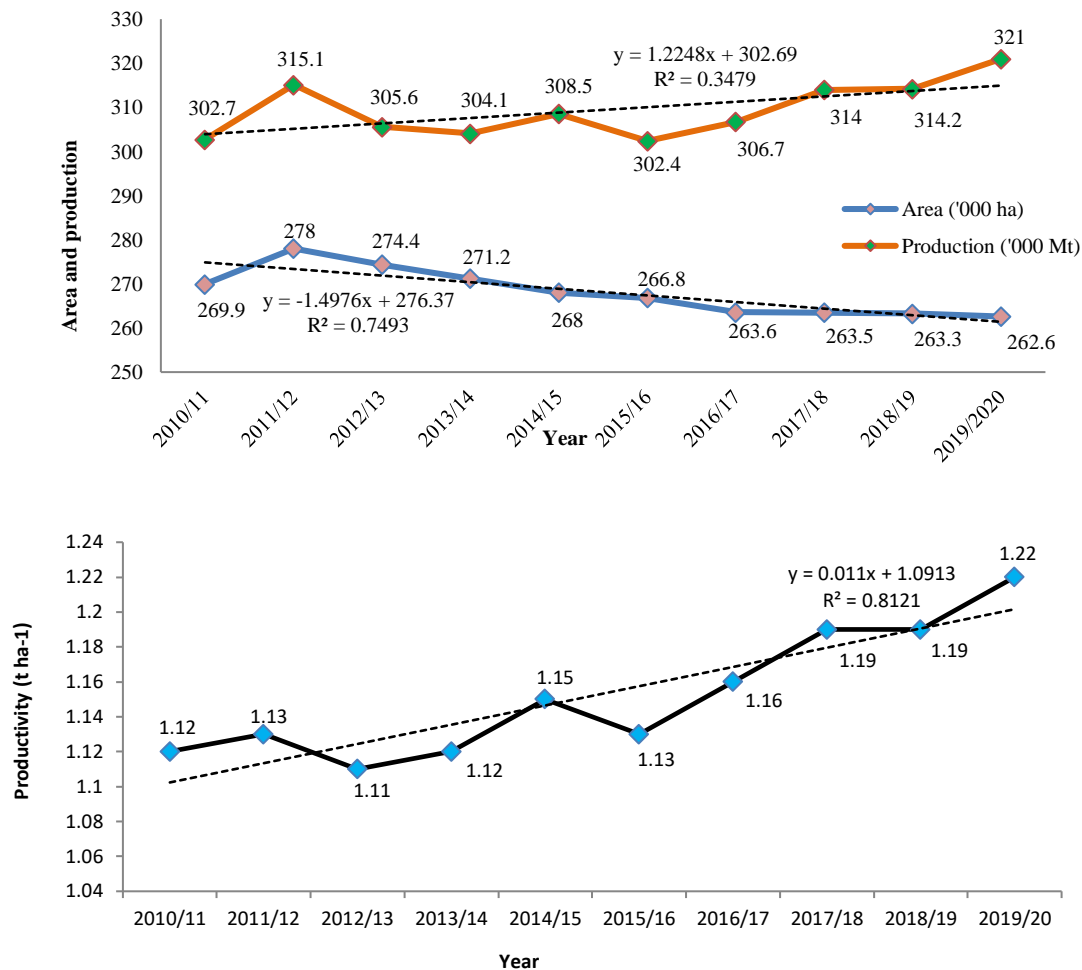


Figure 2. Trend of cultivation area and production (a) Productivity (b) of millet in Nepal from 2010/11 to 2019/20.

3.3. Production and trade scenario of Millet in Nepal

Nepal is considered as potential country for millet diversity having the diverse ecological niche, varied farming system and location reflecting the suitability of growing diverse type of varieties. Finger millet is grown in all districts of Nepal except two districts of high hills and four districts of Terai regions but high growth potential exist in mid hills region of Nepal. Among the 15 reported species of millet, three species are found in Nepal and among those three two are widely cultivated in Nepal. Production area, production, and productivity of millet from 2010/11 to 2019/20 in Nepal is shown in the [Figure 2](#). The figure showed that production area of millet is decreasing, however, the production and productivity is increasing. It can be predicted that Increase in temperature of mid mills area which is most potential area for millet production is one of the potential causes for plummet decrease of existing favorable finger millet areas in Nepal ([Luitel, Siwakoti & Jha, 2019](#)). Similarly, [Zomer et al. \(2014\)](#) found that several climatic factors like moisture stress, changes in minimum and maximum temperature, increasing unpredictable trend of rainfall, and the shift of suitable ecological zones in different elevations in Nepal may

play a role in the substantial decrease of a suitable area of finger millet. The increment in production and productivity of millet is due to increase in awareness about the health benefits, increase in demand and high price. So, the farmers are more conscious about the agronomical practices and selecting varieties. The area under millet cultivation is decreasing because of shift of farmers towards the production of major cereals like rice, wheat, and maize. Finger millet possesses several beneficial characters like high photosynthetic efficiency, nutrient-dense, locally available, and climate resilience with high adaptation to drought and other biotic and abiotic stresses (Gairhe, Gauchan & Timsina, 2021).

Comparing with other crops, Finger millet can be grown even in harsh environment where change in temperature, rainfall, and humidity is more persistent. In such climate change scenario, finger millet can be grown successfully due to its higher adaptability and suitability for low, marginal lands and also for harsh weather conditions.

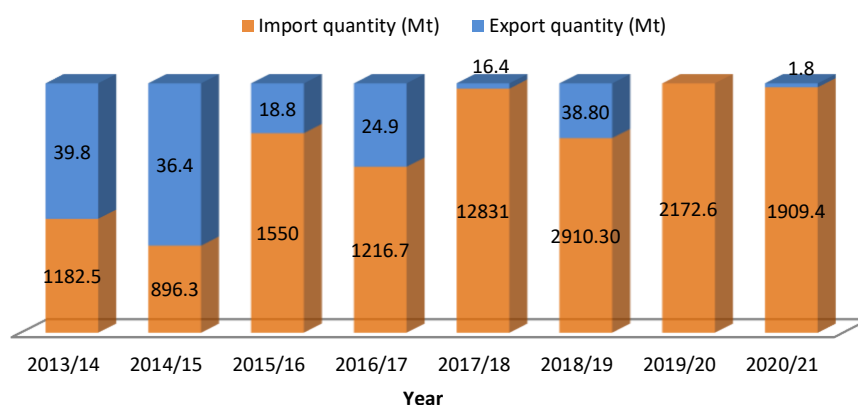


Figure 3. Bar diagram showing the import and export scenario of millet from 2013/14 to 2020/21.

3.4. Trade scenario of millet in Nepal

Export and import scenario of millet is shown in Figure 3. The graph and trend line shows that import and export is inconsistent in different year. It shows that the export is decreasing while import is increasing. The diagram shows that Nepal exports insignificant amount of millet as compared to import. High variability is seen in both import and export of millet with highest import in 2018/19 (2910.3 mt) and highest export in 2013/14 (39.8 mt). In 2019/20 Nepal has not exported millet whereas, in 2020/21 the export quantity was just 1.8 metric tons. The import of millet is high because of increasing in demand of local liquor made from it. India is a major country for finger millet import in Nepal and major portion of import goes in liquor production without any linkage in the domestic value chain (Gauchan, Bhandari, Gurung, Joshi & Jarvis, 2019). Study conducted by Gairhe, Gauchan and Timsina (2021) revealed that millet import value and millet production in Nepal are rising at the rate of 14.62% and 0.47 % per year respectively. Higher

import of millet indicates local production is not sufficed to bear the demand of the country. Trade deficit of millet in Nepal can be balanced with high prospect by putting increasing efforts to promote production, productivity and cultivated area for its commercialization by creating nutrition and health value of the products. Higher import of millet indicates that, all the stakeholders and policy makers, involved in millet research, development and extension should take immediate action to increase productivity and area to make the country self-reliant in millet production.

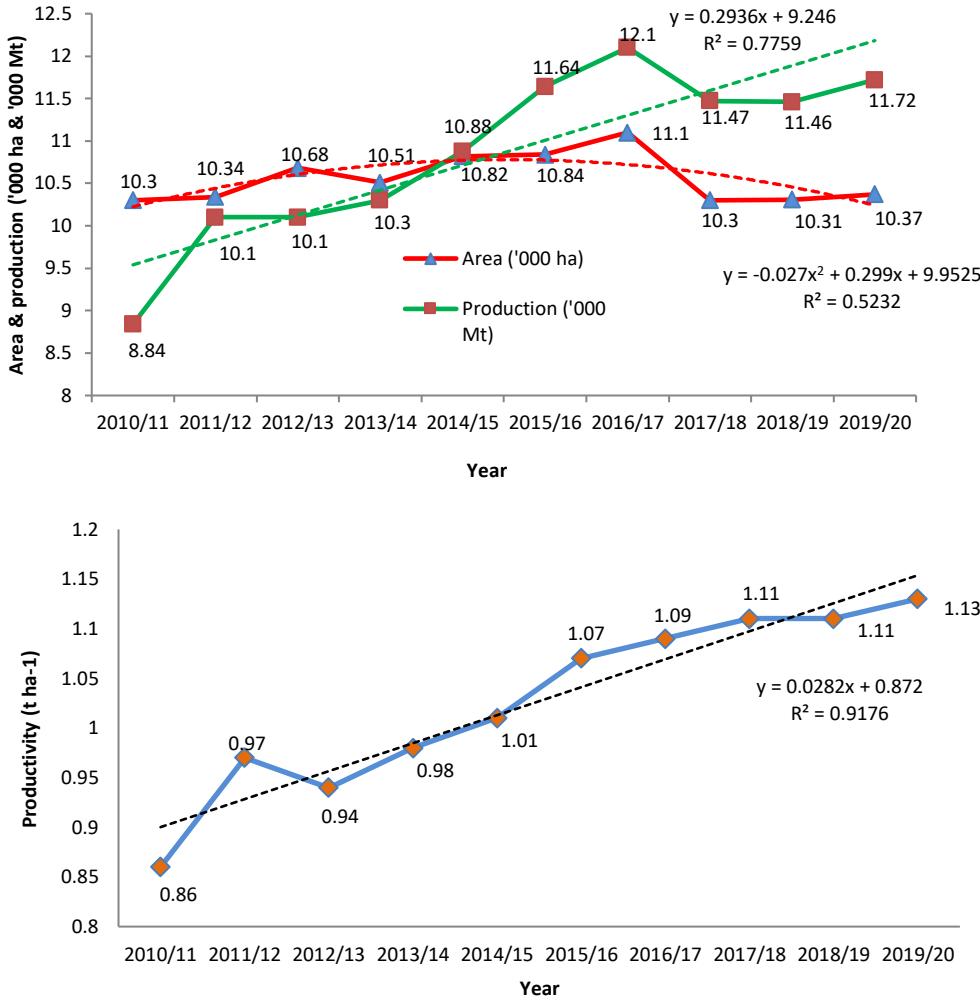


Figure 4. Trend of cultivation area and production (a) Productivity (b) of buckwheat in Nepal from 2010/11 to 2019/20.

3.5. Production and trade scenario of Buckwheat in Nepal

Buckwheat is also called multipurpose crop because it can be cultivated and used for multiple purposes like as staple food, animal feed, vegetable, soup, beverage, and medicine. Among the varied geographical condition, it is the best crop for mid-hills and high-hills in terms of adaptation to different climatic variables and easily fitted to different cropping patterns due to short duration. Buckwheat is the sixth staple food crop of Nepal after rice, wheat, maize, finger millet and barley. Production area, production, and productivity of buckwheat from 2010/11 to

2019/20 in Nepal is shown in the Figure 4. The figure showed that production area of buckwheat remains more or less the same for almost the decade, however, the production and productivity is increasing. The area under buckwheat cultivation is not increasing because of decline in agriculture as plotting of land, leaving the arable land fallow and moving of farmers, especially women from villages to cities. It is also due to the preference of farmers towards the production of major cereals like rice, wheat and maize. The increment in production and productivity of millet is due to increase in use of pollinators (bee pollination) during the flowering time of buckwheat, which increases the pollination of crops that ultimately results in higher production (Aryal, Thapa, Tiwari, & Chaudary, 2016). Quality of seed, time of sowing, ecological site and other numerous geo-climatic factors determines the productivity of this crop. In the year 2010/11, productivity of this crop was only 0.86 tons per hectare while it increased to 1.13 tons per hectare in 2019/20.

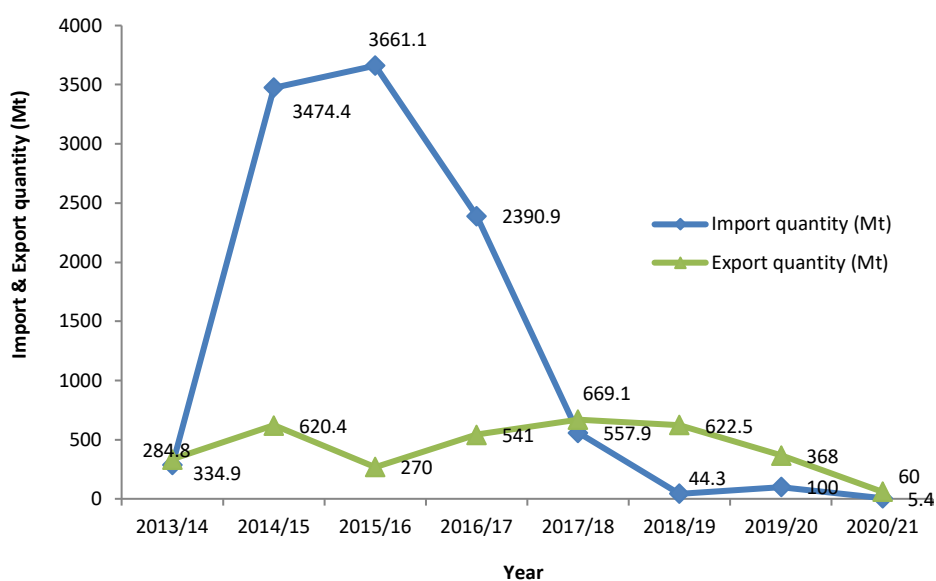


Figure 5. Trend of export and import of buckwheat from 2013/14 to 2020/21 of Nepal

3.6. Trade scenario of Buckwheat in Nepal

Buckwheat is one of the major underutilized crops which is exported from Nepal. The graph shows the export is inconsistent from 2013/14 to 2020/21 and trend line shows 5% increment in the export of Buckwheat (Figure 5). This rise and fall in the export of buckwheat may be due to the inconsistent yield of the crop in that year. Buckwheat was not only exported from Nepal, it is also imported in Nepal. The import is also inconsistent in different year. Import was found highest in 2015/16 with 3661.1 tons and then the import is decreasing continuously in successive years. In Nepal, import of buckwheat decreased by 34.7% in 2016/17, 84.7% in 2017/18 and 97.3% in 2019/20 while comparing with import of 2015/16. Export and import scenario of buckwheat is shown in the line graph. The graph shows that Nepal does not produce the required quantities of

buckwheat so large amount of buckwheat needed to be import. The import was high in 2014/15 and 2015/16 and then the import was decreased and became minimal (5.4 Mt) in 2020/21. Nepal had exported higher amount of buckwheat in 2017/18 which was 669.1 tons while the export decreased by almost 6.9% in 2018/19, 45% in 2019/20 and 91.1% in 2020/21. Negligible import and export of buckwheat in 2020/21 might be due to difficulty of trade in COVID restriction period.

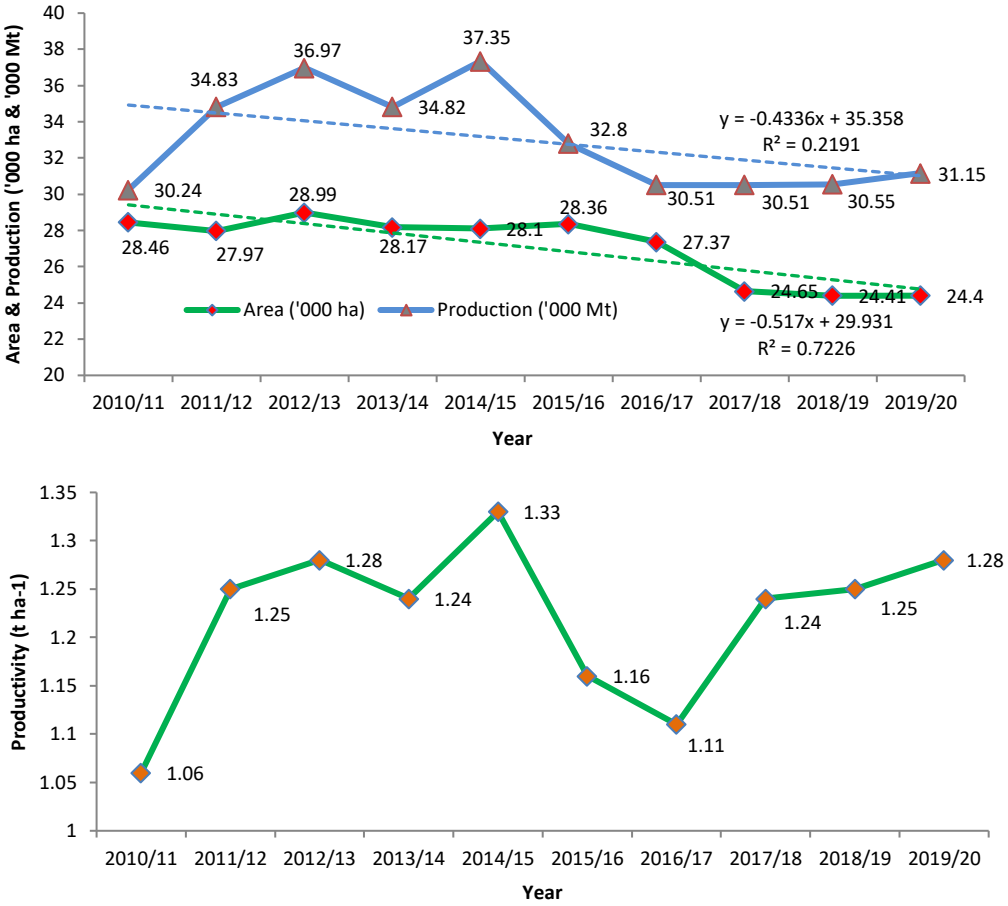


Figure 6. Trend of cultivation area, production (a) and Productivity (b) of barley in Nepal from 2010/11 to 2019/20.

3.7. Production and trade scenario of Barley in Nepal

Barley is one of the major food crops in high hill region of Nepal. Production area, production, and productivity of barley from 2010/11 to 2019/20 in Nepal is shown in the Figure 6. The figure showed that the production area and production of barley is decreasing. It may be due to the shifting of farmers to the market-oriented crops and other cash crops, rely on landrace varieties for production, no proper care by the research stations and so on. The productivity also remains more or less same for almost a decade, so the total production is decreasing. During the period of 2014/15, production of barley was highest having the production amount of 37.35 thousand tons while in 2015/16; it is decreased by 12.2% and in 2019/20 by 16.6%. Area of barley

in Nepal was highest in 2012/13 accounting for 29.99 thousand hectare and it is decreased by almost 15.8% in 2019.20. In previous five years, there is almost stagnation in area cultivated of barley and total production while productivity seems to have increased from 1.11 tons per hectare in 2016/17 to 1.28 tons per hectare in 2019/20. It can be assumed that increased production of barley in previous years is mainly due to the increased productivity of barley. Identification of superior variety and better crop management practices is the most important task for achieving higher productivity. Although barley has the capacity to grow in marginal environmental condition with little inputs management, we should focus on irrigation, the use of fertilizers and insecticides, the introduction of new implements and new seeds of high-yield varieties, and the provision of credit to increase the area, production and productivity of barley in Nepal (Amgai, Pantha, Chhetri & Mudwari, 2011).

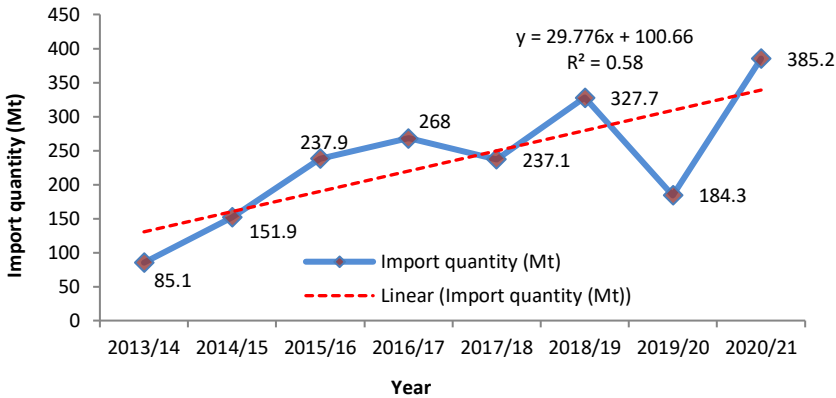


Figure 7. Trend of export and import of barley from 2013/14 to 2020/21 of Nepal

3.8. Trade scenario of Barley in Nepal

Barley, one of the earliest cultivated grains in a wide variety of climate across many geographical regions, is industrially malted and brewed for both food and feed purposes. In Nepal, barley is utilized in food and non-food purposes. It is used to prepare food viz. fermented alcoholic beverages and other food items. The barley seed was never exported from Nepal except in 2014/15 with the nominal export of 23 kg (Figure 7). The import was found to be inconsistent with time. The highest import of barley seed is in 2020/21 having the total import quantity of 385.2 tons. Other barley seed was also not exported from Nepal, but import was done. The trend line shows the increase in import of barley from 2013/14 to 2020/21. There was no export in 2014/15, highest export was done in 2018/19 with 304 thousand kg which worth Rs.11256 thousand. The figure shows that the import of barley is increasing from 2013/14 with the sudden fall in 2019/20. The increase in import of barley is due to its more demand. Barley is believed to regulate blood glucose level and also lowers blood cholesterol (Groves, 2018). The sudden decrease in import in 2019/20 was due to trade restriction in Covid situation.

3.9. Projected demand of underutilized crops (Millet, Barley and Buckwheat) in Nepal

The demand of underutilized crops is increasing year after year, and this will continue in forthcoming years also. It is predicted that, demand of major three underutilized crops of Nepal will be 359.9 thousand tons in 2035 (Figure 8). This is mainly because of raise in awareness about the health benefits of these crops and diversified use. These crops are also grown organically so, the consumers are more attracted towards it (Sharki, S. B, 2020). Knowing the health benefits of millets UN has declared 2023 as the International Year of Millets. It is declared with an aim to increase the public awareness on the health benefits of millets and their suitability for cultivation under tough conditions of climate change (Kumar, S, 2021). Demand of buckwheat is also increasing in Nepal because of its multiple uses. All parts of it are used to care various diseases locally in traditional healthcare system (Luitel, Siwakoti, Joshi, Rangaswami & Jha, 2020). The demand of barley will also increase in the future because of several health benefits (rich in nutrients, reduce risk of heart disease and diabetes, rich in fiber content etc.), also used as raw material in beer industries and has the ability to withstand harsh climatic and soil conditions. Increasing value addition, diversified consumption, major source of food and nutrition for hilly people, increasing demand of derived products and medicinal benefits of these underutilized crops are the main reasons for the increased demand in future.

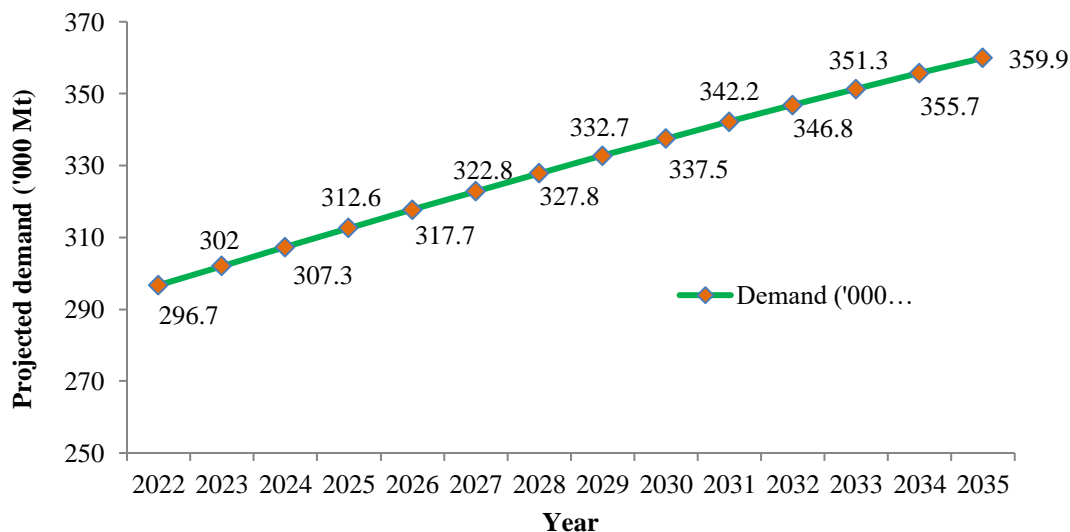


Figure 8. Projected demand of underutilized crops (Millet, Barley and Buckwheat) from 2022 to 2035.

4. Conclusion

This research clearly shows that the production area of barley, millet and buckwheat of World and Nepal are decreasing; however, there is slight increase in the production and productivity of these crops in both World and Nepal. Decrease in production area of underutilized crop is due to the increase in monoculture which are based on industrial field crop production

system (Bavec, Lisec & Bavec, 2018). The adoption of high-yielding rice, maize, wheat varieties worldwide has led to the large-scale loss of plant genetic diversity and erosion of biodiversity (Reeves, Thomas & Ramsey, 2016). These underutilized crops are more nutritious, climate-resilient, and also have medicinal values. So, priority should be given to them for genetic improvement, product diversification, commercialization and for exploring their medicinal values (Joshi *et al.*, 2020). In Nepal, least focus on research, very little or no incentives given to the local crop producer, lack of nutritional knowledge, low status given to underutilized crops, inadequate marketing facility etc. are the major challenges of Nepalese farming system regarding underutilized crops (Koirala, 2020). From this research it is found that the export is decreasing and import of underutilized crops is increasing but, this trend is instable. This may be due to the decrease in production of crop which results in increase in the import of crop because Nepalese agriculture largely depends on irrigation condition and change in the climatic patterns over the year results in unpredictable production patterns (Devkota, 2004).

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