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**Research Article**

# An Analysis of Agriculture Production Scenario in Nepal

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## Abstract

The study is conducted with an aim to study the overall scenario of agriculture production in Nepal. Time series data (2009/10 -2018/19) published by Ministry of Agriculture and Livestock Development is used to calculate the annual average yield of agricultural crops. The result shows that increment in production of cereal crops and vegetables is greater than area due to availability of irrigation facilities and fertilizers, use of improved and hybrid seeds and technological knowledge among the farmers. The percentage increase in area, production and productivity of cash crop in 2018/19 compared to 2009/10 is 18%, 34.38% and 14.1% respectively. The technological innovations and use of high yielding varieties has played a major role to increase production of pulses in Nepal. Among pulses, the winter crop lentil dominates in production (65.76%) as well as in area coverage (62.93%). There is greater increment in areas of fruits compared to production leading to 2% decrease in productivity of fruits in 2018/19 compared to 2009/10. Summer fruits shared 63% and 67.1% of total fruit productive areas and total fruit production respectively. More than 75% of total summer fruits area and production is shared by mango and banana. Citrus fruits shared about 23% of total fruit productive area and production. Winter fruits shared 13.22% of total productive area and 9.80% of total fruit production. In addition to modern technology, status of soil fertility, crop management practices, quality of seeds, climate and incidence of pests and diseases are responsible for fluctuation of agricultural production in Nepal.

**Keywords:** Agriculture; cereal crops; cash crops; pulses; fruits; vegetables; Nepal



## Introduction

Agriculture sector is central to Nepalese economy and contributed 27% to Gross Domestic Product (GDP) during the fiscal year 2018/2019 (MoF, 2019). Out of country's total population of 26,494,504 (CBS, 2011) the majority of the people (65.2%) depends on agriculture for their livelihood (MoALD, 2019). Recent data from government revealed that out of country's total area of 147181sq km, 21% is occupied by cultivated land, 39.60% by forest and shrubs whereas uncultivated land suitable for cultivations accounts to 7% of total area (MoALD, 2020a). This land is unequally distributed between three major agro-ecological zones. The Terai plains accounts to 23% of total Nepalese land, 40% of which is available for agriculture, the Hilly region with 42% of landmass and 20% under cultivation, and the Mountain region occupying 35% of landmass and only 5% under cultivation (OIBN, 2017). The annual growth rate of GDP by agriculture and forestry in 2018/19 was 5.02% (MoALD, 2020b). Agriculture in Nepal is mostly small-scale subsistence and integrated farming consisting of crop and livestock along with reduced economics of scale in production and marketing.

According to CBS (2013), Nepal experienced a negative trend in the average farm size (from 1.12 hectares in

1995/96 to 0.8 ha in 2003/04 and to 0.7ha in 2010/11). 52.7% of households were operating with less than 0.5 ha, 42.9 % households were operating at 0.5-2ha and only 4.4% of households were operating at 2ha and above (CBS, 2013). Therefore, based on the FAO's threshold size of 2 ha (FAO, 2015), 78% of Nepali farmers are smallholder farmers. Average agriculture land holding per individual is 0.2 ha in Nepal. Nepalese agriculture is heavily dependent on rainfall and only 44% of the cultivated land has irrigation facility. In addition to modern technology, several other factors such as fragmentation of land, limited irrigation, unreliability of rainfall, soil fertility, farm management practices and prevalence of disease and pest etc. are responsible for the fluctuation of agricultural production.

Paddy, wheat and maize are the major cereal crops cultivated in Nepal whereas millet, buckwheat and barley are the minor cereals in terms of area of cultivation. Vegetable production is considered as prominent income-generating options for farmers which have led to increased area under vegetable production (Rai et al., 2019). Fruits and spice crops shared about 7.04% to agricultural GDP. Among them, Mango, Banana, Apple, Orange and spice crops shared about 1.56%, 0.4%, 0.42%, 0.97% and 1.79% respectively to agricultural GDP (Pandey et al., 2017). Oilseed, sugarcane and potato are the principal cash crops whereas jute, cotton and rubbers are minor in terms of area and production in Nepal. Though a large portion of the population are involved in agriculture, Nepal imports huge amounts of agricultural commodities such as spices, food grains, potatoes, edible oils, fruits and vegetables from other countries for daily consumption. The export has stagnated in the recent year whereas import has skyrocketed leading to trade deficit (Ghimire, 2016).

The study is conducted to explore the agriculture production and yield analysis of cereal crops, cash crops, pulses, fruits and vegetables in Nepal. It also aims to suggest further study regarding agricultural production and marketing in Nepal.

## Materials and Methods

Time series agricultural data in Nepal is collected from the data books published by MoALD for 10 years' time period from 2009/10 to 2018/19. The method of data analysis is referred from (Bhandari, 2012). The total yield of major cereals, cash crops, pulses, fruits and vegetables are calculated as in equation 1. The value of total yield is computed for 10 years period from 2009/10 to 2018/19 which is used to study the trend of the agricultural production in Nepal.

$$TYn = \{(TP_{rice} + TP_{maize} + TP_{wheat} + TP_{millet} + TP_{barley} + TP_{buckwheat})/ (TA_{rice} + TA_{maize} + TA_{wheat} + TA_{millet} + TA_{barley} + TA_{buckwheat})\} X 1000 \quad (1)$$

Where,

TY= Total yield; TP= Total production; TA=Total area; n= No. of year

Annual average yield (AAY) is calculated to identify the years of agricultural crops which has production below average as in equation 2.

$$\text{(Annual average yield) } AAY = (\text{Total yield}_{2009/10} + \text{Total yield}_{2010/11} + \ldots\ldots + \text{Total yield}_{2018/19})/ \text{No. of years} \quad \ldots\ldots (2)$$

In order to carry out the statistical analysis of yield, Microsoft excel program was used. Table and line graph are used to interpret the results.

## Results and Discussions

### CEREAL CROPS

The average annual yield of cereal crops for 10 years period from 2009/10 to 2018/19 is 2.70Mt $ha^{-1}$. The total yield is below average in the years 2009/10, 2010/11, 2012/13, 2015/16 which is 2.29Mt $ha^{-1}$, 2.48Mt $ha^{-1}$, 2.61Mt $ha^{-1}$ and 2.61Mt $ha^{-1}$ respectively. Total yield is above average in the years 2011/12, 2013/14, 2014/15, 2016/17, 2017/18 and 2018/19 which is 2.71Mt $ha^{-1}$, 2.75Mt $ha^{-1}$, 2.74Mt $ha^{-1}$, 2.80Mt $ha^{-1}$, 2.92Mt $ha^{-1}$ and 3.10Mt $ha^{-1}$ respectively.

Area under cereal crops cultivation is exposed to high fluctuation in recent years with maximum area allocated in year 2016/17. Sharp decline on area of cereal cultivation was observed during the years 2012/13 and 2015/16, however production is increasing continously after 2015/16 (Fig. 1). Though area under cereal cultivation in 2018/19 is less compared to 2016/17, maximum production ( 10685550Mt) is observed which is due to availability of irrigation facilities, use of improved and hybrid seeds, availability of chemical fertilizers and technological knowledge among the farmers. The percentage increase in area, production and productivity of the cereal crops in 2018/19 compared to 2009/10 is 2%, 38% and 35% respectively.

Paddy is the most important cereal crop followed by maize and wheat, both in terms of cultivated area and in terms of production. During the fiscal year 2018/19, cereal crops were cultivated in total area of 3450164 ha which led to 1068550Mt of production and 3.1Mt/ha yield. Paddy, Maize and Wheat accounted to 43.24%, 27.72% and 20.40% of total cereal cultivated area respectively. Millet, buckwheat and barley occupied small area of 7.63%, 0.3% and 0.71% of total cereal cultivated area respectively. Because of small area, the variation in production is high in barley, as minor changes of few thousand hectares may lead to big changes in crop production (Table 1).

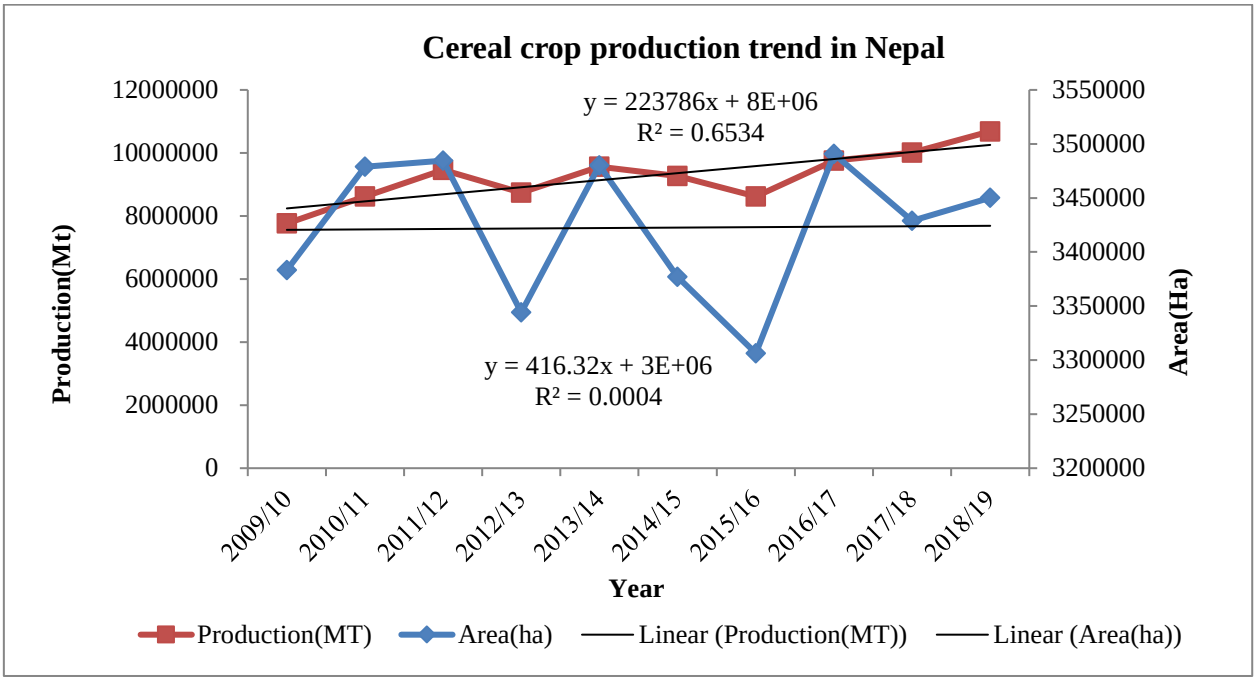


**Fig. 1**: Cereal crop production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 1**: Overall scenario of cereal production in Nepal (2018/19)

| Cereal Crops | Area (ha) | Production (Mt) | Yield (Mt ha$^{-1}$) |
|---|---|---|---|
| Paddy | 1491744 | 5610011 | 3.76 |
| Maize | 956447 | 2713635 | 2.84 |
| Wheat | 703992 | 2005665 | 2.84 |
| Millet | 263261 | 314225 | 1.2 |
| Buckwheat | 10311 | 11464 | 1.1 |
| Barley | 24409 | 30550 | 1.25 |
| **Total** | **3450164** | **10685550** | **3.1** |

[Source: MoALD(2020), Statistical Information on Nepalese Agriculture, 2018/19]

***National level average yield analysis for individual cereal crops from 2009/10 to 2018/19***

**Paddy**: The average yield of paddy for 10-year time period from 2009/10 to 2018/19 is 3.30Mt ha$^{-1}$. The yield is below average in the years 2009/10, 2010/11, 2012/13 and 2015/16 whereas the yield is above average in the years 2011/12, 2013/14, 2014/15, 2016/17, 2017/18 and 2018/19 (Table 2). Paddy yield is quite variable from farm to farm and from country to country. The percentage increase in area, production and productivity of paddy in 2018/19 compared to 2009/10 is 1%, 39% and 38% respectively.

**Maize:** The average yield of maize for 10-year time periods from 2009/10 to 2018/19 is 2.50Mt ha$^{-1}$. The yield is below average in the years 2009/10, 2010/11, 2012/13, 2013/14, 2014/15 whereas the yield is equal to average in the years 2011/12 and 2015/16 whereas yield is above average in the years 2016/17, 2017/18 and 2018/19 (Table 2). The percentage increase in area, production and productivity of maize in 2018/19 compared to 2009/10 is 9%, 46% and 34% respectively.

**Wheat:** The average yield of wheat for 10-year time period from year 2009/10 to 2018/19 is 2.50Mt ha$^{-1}$. The yield is below average in the years 2009/10, 2010/11, 2011/12, 2012/13 and 2015/16. The yield is equal to average yield in the year 2013/14 whereas above average in the year 2014/15, 2016/17, 2017/18 and 2018/19 (Table 2). The percentage decrease in area, and increase in production and productivity of wheat in 2018/19 compared to 2009/10 is 3.71%, 28.85% and 34% respectively.

**Millet:** The average yield of millet for 10-year time period from the year 2009/10 to 2018/19 is 1.10Mt ha$^{-1}$. The yield is above average in all years from 2009/10 to 2018/19 (Table 2). The percentage decrease in area, and increase in production and productivity of millet in 2018/19 compared to 2009/10 is 1.94%, 5% and 6% respectively.

**Barley:** The average annual yield of barley for 10-year time period from 2009/10 to 2018/19 is 1.20Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11, 2015/16 and 2016/17. The yield is above average in the year 2011/12, 2012/13, 2013/14, 2014/15, 2017/18 and 2018/19(Table 2). The percentage decrease in area, and increase in production

and productivity of barley in 2018/19 compared to 2009/10 is 8%, 11% and 20% respectively.

**Buckwheat:** The average yield of buckwheat for 10-year time period from the year 2009/10 to 2018/19 is 0.90. The yield is below average in the year 2010/11 which was 0.86Mt $ha^{-1}$. The yield is above average in the year 2011/12, 2012/13, 2013/14, 2014/15, 2015/16, 2016/17, 2017/18 and 2018/19 (Table 2). The percentage increase in area, production and productivity of buckwheat in 2018/19 compared to 20010/11 is 0.07%, 30% and 29% respectively.

## CASH CROPS

The average annual yield of cash crops for 10-year time period from year 2009/10 – 2018/19 is 12.48Mt $ha^{-1}$. The yield is below average in years 2009/10, 2010/11, 2011/12, 2012/13, 2014/15 which is 11.44Mt $ha^{-1}$, 11.53Mt $ha^{-1}$, 11.88Mt $ha^{-1}$, 11.89Mt $ha^{-1}$, and 11.56Mt $ha^{-1}$ respectively. The yield is above average in the year 2013/14, 2015/16, 2016/17, 2017/18, 2018/19 which is 12.68Mt $ha^{-1}$, 14.54Mt $ha^{-1}$, 12.78Mt $ha^{-1}$, 13.47Mt $ha^{-1}$ and 13.05Mt $ha^{-1}$ respectively.

There was a sharp decline in area and production of cash crops during the year 2016/17. But, during the last 2 years there has been a sharp increase in terms of production and area allocated for cash crop cultivation (Fig.2). Cash crop farming over time remains as a viable means of increasing income, ensuring security of small holder farmers, improves food security along with sustainable agricultural development. The percentage increase in area, production and productivity of the cash crops in 2018/19 compared to 2009/10 is 18%, 34.38% and 14.1% respectively.

**Table 2**: National level average yield analysis for individual cereal crops from year 2009/10 – 2018/19

| YEAR | PADDY | MAIZE | WHEAT | MILLET | BARLEY | BUCKWHEAT |
|---|---|---|---|---|---|---|
| | | | Yield (Mt $ha^{-1}$) | | | |
| 2009/10 | 2.72 | 2.12 | 2.13 | 1.12 | 1.04 | 0.00 |
| 2010/11 | 2.98 | 2.28 | 2.27 | 1.12 | 1.06 | 0.86 |
| 2011/12 | 3.31 | 2.50 | 2.41 | 1.13 | 1.25 | 0.97 |
| 2012/13 | 3.17 | 2.35 | 2.48 | 1.11 | 1.28 | 0.94 |
| 2013/14 | 3.39 | 2.46 | 2.50 | 1.12 | 1.24 | 0.98 |
| 2014/15 | 3.36 | 2.43 | 2.59 | 1.15 | 1.33 | 1.01 |
| 2015/16 | 3.15 | 2.50 | 2.33 | 1.13 | 1.16 | 1.07 |
| 2016/17 | 3.37 | 2.55 | 2.55 | 1.16 | 1.11 | 1.09 |
| 2017/18 | 3.51 | 2.68 | 2.76 | 1.19 | 1.24 | 1.11 |
| 2018/19 | 3.76 | 2.84 | 2.85 | 1.19 | 1.25 | 1.11 |
| **AAY (Mt $ha^{-1}$)** | **3.30** | **2.50** | **2.50** | **1.10** | **1.20** | **0.90** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

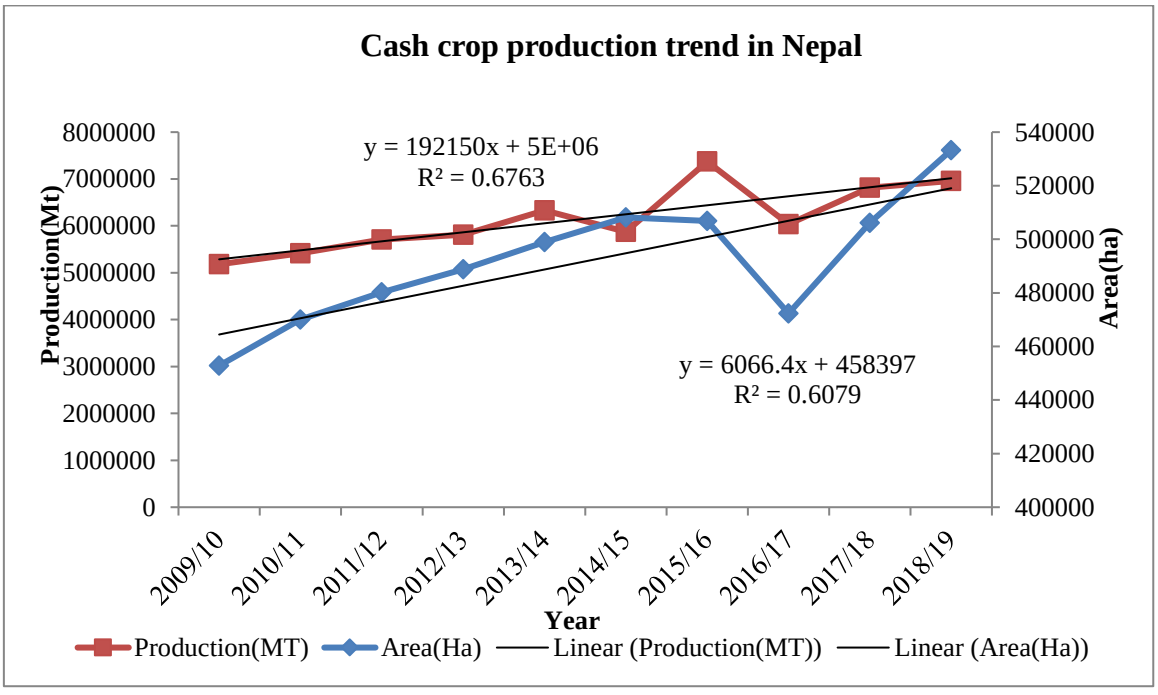


**Fig. 2**: Cash crop production trend in Nepal

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 3**: Overall scenario of cash crops production in Nepal (2018/19)

| CASH CROPS | AREA (ha) | PRODUCTION(Mt) | Yield (MT ha$^{-1}$) |
|---|---|---|---|
| OILSEED | 260307 | 280530 | 1.08 |
| SUGARCANE | 71625 | 3557934 | 49.67 |
| POTATO | 193997 | 3112927 | 16.05 |
| JUTE | 7285 | 10585 | 1.453 |
| COTTON | 97 | 99 | 1.021 |
| RUBBER | 476 | 249 | 0.52 |
| **Total** | **533787** | **6962324** | **13.05** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

Oilseed, sugarcane and potato are the principal cash crops whereas jute, cotton and rubber are the minor cash crops in Nepal. During the fiscal year 2018/19, cash crops were cultivated in total area of 533787ha with total production of 6962324Mt and 13.05Mt/ha of yield (Table 3). Oilseed, sugarcane and potato occupied 48.77%, 13.42%, 36.34% of total cash crop cultivated areas respectively whereas jute, cotton and rubber occupied only 1.36%, 0.018% and 0.089% of total cash crop cultivated areas respectively. Jute was cultivated in seven districts of Nepal: Ilam, Jhapa, Morang, Sunsari, Saptari, Siraha and Udaypur. Morang district had the highest shares in terms of area (5075ha) and production (7700 Mt) of jute cultivation in Nepal. Similarly, cotton was cultivated in only 3 districts of Nepal; Dang, Banke and Mugu. Dang district had the highest shares in terms of area (85ha) and production (87Mt) of cotton in Nepal. Banke and Mugu districts, both accounted to 5ha area and 7Mt production of cotton respectively. Rubber was cultivated in 4 districts; Jhapa, Ilam, Morang and Sunsari. Jhapa, Illam, Morang and Sunsari shared 58.40%, 36.34%, 3.15% and 2.1% of total area under rubber cultivation in Nepal, respectively. Similarly, 61.45%, 33.74%, 2.81% and 2.01% of total production of rubber in Nepal were produced in Jhapa, Illam, Morang and Sunsari respectively.

***National level average yield analysis for individual cash crops from year 2009/10 to 2018/19***

***Oilseed***

The average annual yield of oilseed for 10-year time period from year 2009/10 to 2018/19 is 0.81Mt ha$^{-1}$. The yield is below average in the years from 2009/10 to 2017/18 which is 0.78Mt ha$^{-1}$ in all years. The yield was above average only in 2018/19 which is 1.08Mt ha$^{-1}$(Table 4). The percentage increase in area, production and productivity of oilseeds in 2018/19 compared to 2009/10 is 31.11%, 80.93% and 38.46% respectively.

***Potato***

The average annual yield of potato for 10-year time period from year 2009/10 to 2018/19 is 14.12 Mt ha$^{-1}$. The yield is below average in all other years except 2017/18 and 2018/19 which indicates the increasing trend of potato yield in recent years (Table 4). The percentage increase in area, production and productivity of potato in 2018/19 compared to 2009/10 is 4.67%, 23.64% and 18.18% respectively.

***Sugarcane***

The average annual yield of sugarcane for 10-year time period from year 2009/10 to 2018/19 is 46.007Mt ha$^{-1}$. The yield is above average only in the years 2015/16 and 2018/19 (Table 4). The percentage increase in area, production and productivity of sugarcane in 2018/19 compared to 2009/10 is 22.83%, 42.59% and 16.08% respectively.

***Jute***

The average annual yield of jute for 10-year time period from year 2009/10 to 2018/19 is 1.407Mt ha$^{-1}$. The yield is below average in the years 2009/10 to 2012/13 whereas above average in the year 2013/14 to 2018/19 (Table 4). The percentage decrease in area, production and increase productivity of jute in 2018/19 compared to 2009/10 is 30.70%, 18.31% and 17.89% respectively.

***Cotton***

The average yield of cotton for 10-year time period from year 2009/10 to 2018/19 is 0.986Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2012/13 and 2016/17 whereas yield is above average in the year 2010/11, 2011/12, 2013/14, 2014/15, 2015/16, 2017/18 and 2018/19 (Table 4). The percentage decrease in area, production and increase in productivity of cotton in 2018/19 compared to 2009/10 is 19.83%, 9.17% and 13.33% respectively.

**PULSES**

The annual average yield of pulses for 10-year time period from 2008/09 to 2018/19 is 1.14Mt ha$^{-1}$. The yield is below average in the year 2008/09, 2009/10, 2010/11, 2011/12, 2012/13, 2013/14, 2014/15 and 2015/16 which is 0.82 Mt ha$^{-1}$, 0.82 Mt ha$^{-1}$, 0.95 Mt ha$^{-1}$, 0.96 Mt ha$^{-1}$, 1.07 Mt ha$^{-1}$, 1.07 Mt ha$^{-1}$,1.08 Mt ha$^{-1}$ and 1.11 Mt ha$^{-1}$ respectively. The yield is above average in the year 2016/17, 2017/18 and 2018/19 which is 1.16 Mt ha$^{-1}$, 1.18 Mt ha$^{-1}$ and 1.15 Mt ha$^{-1}$ respectively.

There is a high fluctuation in area under pulse cultivation in Nepal in the last 10 years. The production of pulses has been continuously increasing whereas there was sharp

decline in area in the year 2017/18 (Fig.3). The technological innovations and use of high yielding varieties has played a major role to increase production and productivity of pulses in Nepal. The percentage increase in area, production and productivity of the pulse crops in 2018/19 compared to 2009/10 is 6%, 50 %, and 41% respectively.

During the fiscal year 2018/19, pulses were cultivated in a total area of 331740 Ha with total production of 381987 Mt and 1.15Mt $ha^{-1}$ yield (Table 5). Lentil, Pigeon pea, black gram, grass pea, horse gram, soybean and other (which include Field Pea, Cow Pea, Broad Bean, Phaseolus, Masyang, Mungi etc.) are the pulses cultivated in Nepal. Among pulses, the winter crop lentil dominates in production (65.76%) as well as in area coverage (62.93%). Chickpea, pigeon pea, black gram, grass pea horse gram, soybean and other pulses occupied 2.91%, 5.05%, 7.08%, 2.40%, 1.84%, 7.59% and 10.20% in terms of total pulse area respectively whereas contributed 2.79%, 4.33%, 5.22%, 2.44%, 1.51%, 8.26% and 9.69% in terms of total pulse production respectively. We can say that lentil will continue to dominate in future as well since lentil is prioritized by Agricultural Development Strategy 2015-2035 in Nepal.

**Table 4**: National level annual average yield analysis for individual cash crops from year 2009/10 to 2018/19

| Year | Oilseed | Potato | Sugarcane | Jute | Cotton |
|---|---|---|---|---|---|
| | | Yield (Mt $ha^{-1}$) | | | |
| 2009/10 | 0.78 | 13.58 | 42.79 | 1.23 | 0.9 |
| 2010/11 | 0.78 | 13.74 | 43.15 | 1.37 | 1 |
| 2011/12 | 0.78 | 13.58 | 45.45 | 1.37 | 0.99 |
| 2012/13 | 0.78 | 13.64 | 45.44 | 1.37 | 0.86 |
| 2013/14 | 0.78 | 13.7 | 43.14 | 1.44 | 1.02 |
| 2014/15 | 0.78 | 13.13 | 45.99 | 1.45 | 1.11 |
| 2015/16 | 0.78 | 14.03 | 53.71 | 1.45 | 1.03 |
| 2016/17 | 0.78 | 13.94 | 45.47 | 1.47 | 0.89 |
| 2017/18 | 0.78 | 15.81 | 45.26 | 1.47 | 1.04 |
| 2018/19 | 1.08 | 16.05 | 49.67 | 1.45 | 1.02 |
| **AAY (Mt $ha^{-1}$)** | **0.81** | **14.12** | **46.007** | **1.407** | **0.986** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

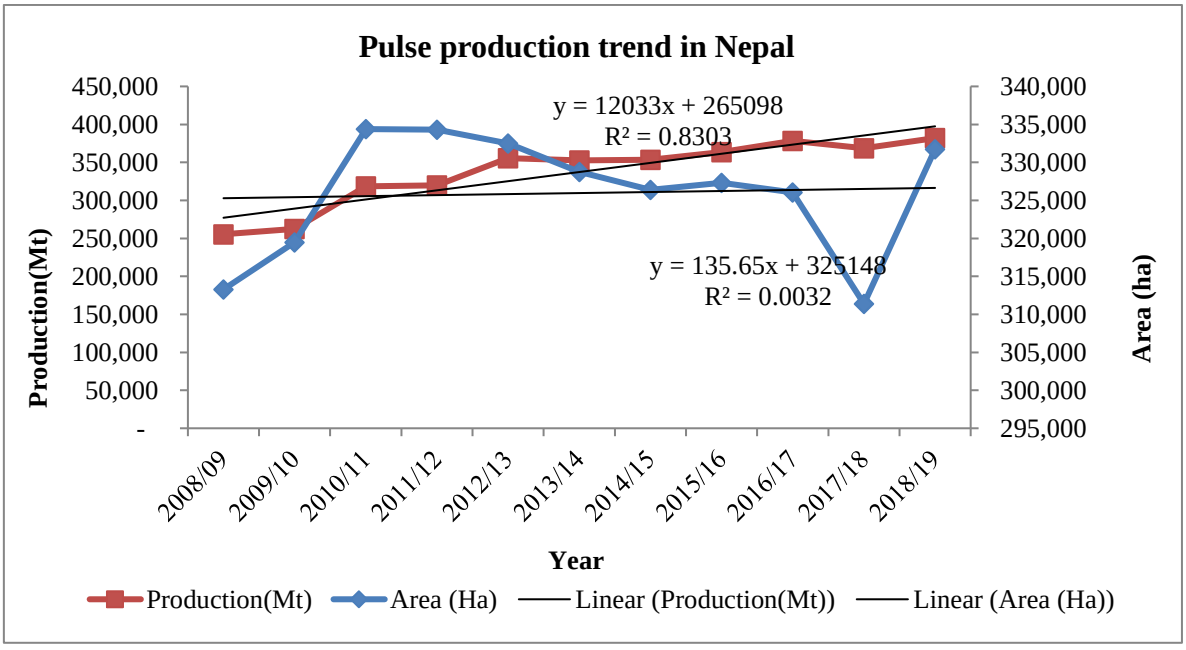


**Fig. 3**: Pulse production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 5**: Overall scenario of pulses production in Nepal (2018/19)

| Pulses | Area (ha) | Production (Mt) | Yield (Mt ha$^{-1}$) |
|---|---|---|---|
| Lentil | 208766 | 251185 | 1.2 |
| Chickpea | 9653 | 10675 | 1.11 |
| Pigeon pea | 16753 | 16538 | 0.99 |
| Black Gram | 23492 | 19928 | 0.85 |
| Grass Pea | 7952 | 9329 | 1.17 |
| Horse Gram | 6119 | 5754 | 0.94 |
| Soybean | 25179 | 31567 | 1.25 |
| Others | 33826 | 37011 | 1.09 |
| **Total** | **331740** | **381987** | **1.15** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

***National level average yield analysis for individual pulse crops from year 2009/10 to 2018/19***

***Lentil***

The annual average yield of lentil for 10-year time period from 2009/10 to 2018/19 is 1.10Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12, equal to average in the year 2012/13 and 2013/14 and above average since the year 2014/15 to 2018/19 (Table 6). The percentage increase in area, production and productivity of lentil in 2018/19 compared to 2009/10 is 11.37%, 65.5% and 48.5% respectively.

***Chickpea***

The annual average yield of chickpea for 10-year time period from 2009/10 to 2018/19 is 1.01Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11, 2011/12, 2012/13 and 2013/14. The yield is equal to average in the year 2014/15 whereas above average in the year 2015/16, 2016/17, 2017/18 and 2018/19 (Table 6). The percentage increase in area, production and productivity of chickpea in 2018/19 compared to 2009/10 is 11.63%, 51.09% and 35.37% respectively.

***Pigeon pea***

The annual average yield of pigeon pea for 10-year time period from 2009/10 to 2018/19 is 0.93Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12, and above average since the year 2012/13 to 2018/19 (Table 6). The percentage decrease in area and production and percentage increase in productivity of pigeon pea in 2018/19 compared to 2009/10 is 21.33%, 11.31% and 12.67% respectively.

***Black gram***

The annual average yield of black gram for 10-year time period from 2009/10 to 2018/19 is 0.83Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12, equal to average in the year 2013/14, 2015/16, 2016/17, and above average in the year 2012/13, 2014/15, 2017/18 and 2018/19 (Table 6). The percentage decrease in area and production and percentage increase in productivity of black gram in 2018/19 compared to 2009/10 is 30.45%, 25.28% and 7.34% respectively.

***Grass pea***

The annual average yield of grass pea for 10 years' time period from 2009/10 to 2018/19 is1.10 Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12 whereas above since the year 2012/13 to 2018/19 (Table 6). The percentage increase in area, production and productivity of grass pea in 2018/19 compared to 2009/10 is 32.84%, 109.5% and 58% respectively.

***Horse gram***

The annual average yield of horse gram for 10 years' time period from 2009/10 to 2018/19 is 0.85Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12, and above average since the year 2012/13 to 2018/19 (Table 6). The percentage decrease in area and increase in production and productivity of horse gram in 2018/19 compared to 2009/10 is 23.51%, 4.01% and 35.33% respectively.

***Soybean***

The annual average yield of soybean for 10-year time period from 2009/10 to 2018/19 is 1.14Mt ha$^{-1}$. The yield is above average in the year 2009/10, 2010/11, 2011/12 whereas the yield is above average since 2012/13 to 2018/19 (Table 6). The percentage increase in area, production and productivity of Soybean in 2018/19 compared to 2009/10 is 5.16%, 43.21% and 36.15% respectively.

***Others***

The average yield of other pulses for 10-year time period from 2009/10 to 2018/19 is 1.02Mt ha$^{-1}$. The yield is below average in the year 2009/10, 2010/11 and 2011/12 and above average in the years since 2012/13 to 2018/19. The percentage increase in area, production and productivity of other pulses (which includes field pea, cow pea, broad bean, Phaseolus, Masyang, Mungi etc.) in 2018/19 compared to 2009/10 is 11.33%, 41.34% and 26.91% respectively.

**FRUITS**

The average annual yield of fruits for time period of 10 years from 2009/10 to 2018/19 is 9.48Mt ha$^{-1}$. The yield is above average in the year 2009/10, 2010/11, 2011/12, 2017/18 and 2018/19 which is 10.0 Mt ha$^{-1}$, 10.0Mt ha$^{-1}$, 10.2Mt ha$^{-1}$, 9.7 Mt ha$^{-1}$ and 9.8 Mt ha$^{-1}$ respectively. There was a sharp decline in the yield in the year 2012/13,

2012/14, 2014/15, 2015/16 and 2016/17 which is 9.3 Mt ha$^{-1}$, 8.8 Mt ha$^{-1}$, 9.0 Mt ha$^{-1}$, 8.8 Mt ha$^{-1}$ and 9.2 Mt ha$^{-1}$ respectively.

In Nepal, both area and production of fruits is continuously increasing since 2009/10 but the production was found to decline in the year 2012/13 and 2015/16. Production again started to increase after 2015/16 but there is greater increment in area compared to production (Fig.4). Favorable climatic conditions, improved crop management practices, increased mechanization with expansion of fruit areas and availability of fertilizers and planting stock has led to increase in fruit production in Nepal. The percentage increase in area, productive area, production and decrease in productivity of the fruits in 2018/19 compared to 2009/10 is 53%, 70%, 67% and 2% respectively. During the fiscal year 2018/19, fruits were cultivated in a total productive area of 120023 ha with 1177640Mt of production 9.8 Mt ha$^{-1}$ total yield (Table 7).

Fruits are categorized into three types: i) Citrus Fruits ii) Summer Fruits iii) Winter Fruits.

**Table 6**: National level average yield analysis for individual pulse crops from year 2009/10 to 2018/19

| Year | Lentil | Chickpea | Pigeon pea | Black Gram | Grass Pea | Horse Gram | Soybean | Others |
|---|---|---|---|---|---|---|---|---|
| | | | | Yield (Mt ha$^{-1}$) | | | | |
| 2009/10 | 0.81 | 0.82 | 0.88 | 0.79 | 0.74 | 0.69 | 0.92 | 0.86 |
| 2010/11 | 1.00 | 0.89 | 0.81 | 0.82 | 0.94 | 0.74 | 0.97 | 0.91 |
| 2011/12 | 1.00 | 0.89 | 0.81 | 0.82 | 0.94 | 0.74 | 0.97 | 0.92 |
| 2012/13 | 1.10 | 0.99 | 0.94 | 0.85 | 1.21 | 0.86 | 1.17 | 1.07 |
| 2013/14 | 1.10 | 1.00 | 0.97 | 0.83 | 1.23 | 0.91 | 1.19 | 1.07 |
| 2014/15 | 1.11 | 1.01 | 0.97 | 0.84 | 1.24 | 0.92 | 1.20 | 1.08 |
| 2015/16 | 1.23 | 1.10 | 0.97 | 0.83 | 1.16 | 0.90 | 1.23 | 1.07 |
| 2016/17 | 1.23 | 1.10 | 0.97 | 0.83 | 1.16 | 0.90 | 1.23 | 1.07 |
| 2017/18 | 1.26 | 1.14 | 0.99 | 0.86 | 1.18 | 0.91 | 1.26 | 1.08 |
| 2018/19 | 1.20 | 1.11 | 0.99 | 0.85 | 1.17 | 0.94 | 1.25 | 1.09 |
| **AAY (Mt ha$^{-1}$)** | **1.10** | **1.01** | **0.93** | **0.83** | **1.10** | **0.85** | **1.14** | **1.02** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 7**: Overall scenario of fruit production in Nepal (2018/19)

| Fruits | Area(ha) | Productive Area(ha) | Production (Mt) | Yield (Mt ha$^{-1}$) |
|---|---|---|---|---|
| Citrus | 46411 | 28406 | 271908 | 9.57 |
| Winter | 29410 | 15877 | 115443 | 7.27 |
| Summer | 88802 | 75740 | 790289 | 10.43 |
| **Total** | **164623** | **120023** | **1177640** | **9.81** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

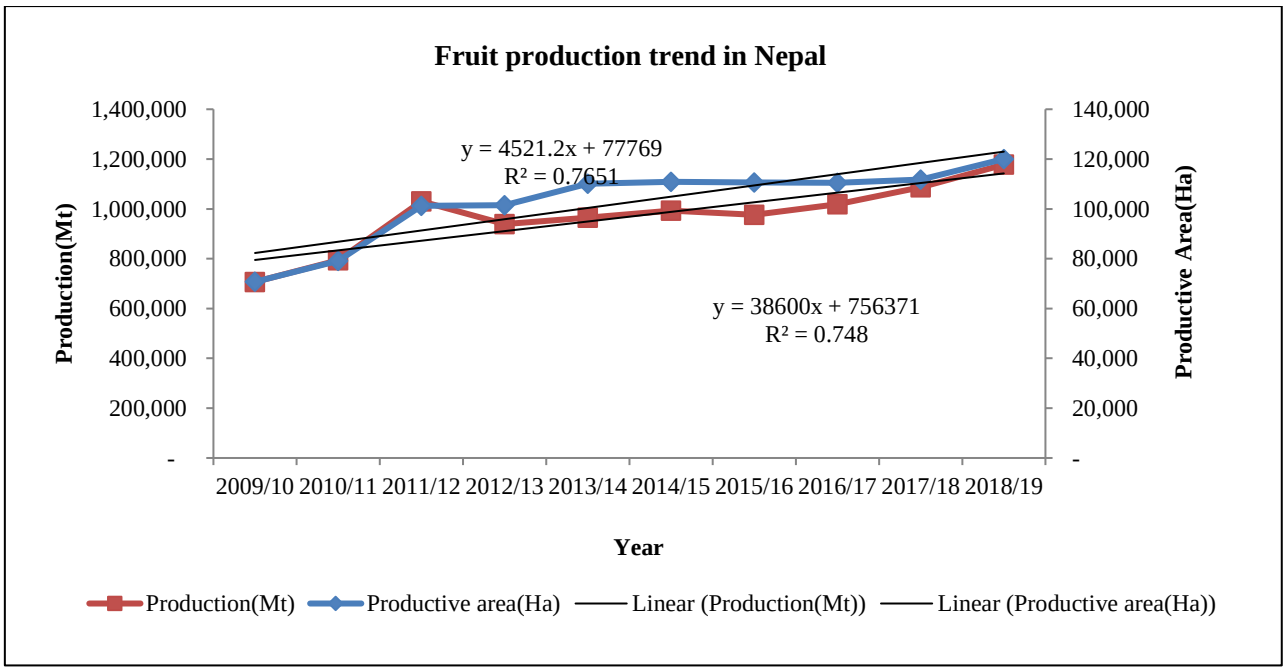


**Fig. 4**: Fruit production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

***Summer Fruits***

The area and production of summer fruits is continuously increasing in Nepal since 2009/10 but production decline was observed in 2012/13 and 2015/16. Production again started to increase after 2015/16 along with the increase in productivity of summer fruits (Fig. 5). The percentage increase in area, productive area, production and yield of summer fruits in 2018/19 compared to 2009/10 is 74.5%, 114.88%, 132.30% and 7.5% respectively. Average yield of summer fruits for time period of 10 year from 2009/10 to 2018/19 is 9.85Mt $ha^{-1}$. The yield is below average in the year 2009/10, 2012/13, 2013/14, 2014/15, 2015/16 , 2016/17 which is 9.7 Mt $ha^{-1}$, 9.6 Mt $ha^{-1}$, 9.2 Mt $ha^{-1}$, 9.3 Mt $ha^{-1}$ ,9.2 Mt $ha^{-1}$ and 9.8 Mt $ha^{-1}$ respectively and above average in the year 2010/11, 2011/12, 2017/18 and 2018/19 which is 10.1 Mt $ha^{-1}$, 10.8 Mt $ha^{-1}$, 10.4 Mt $ha^{-1}$ and 10.43Mt $ha^{-1}$ respectively.

During the fiscal year 2018/19, summer fruits were grown under 53.94% of total fruit growing area, 63% of total fruit productive area and production share by summer fruits was 67.1% of total fruit production. Summer fruits mainly grown in Nepal are mango, banana, guava, jackfruit, pineapple, litchi, arecanut and coconut. Mango alone occupied 56.06% of total summer fruit productive area and contributed 46.33% of total summer fruit production. Banana shared 21.94% of total summer fruit productive area and 35.29% of total summer fruit production. Guava, Papaya, Jackfruit, Pineapple, Litchi, Arecanut and Coconut shared 4.05%, 1.62%, 2.99%, 1.30%, 9.31%, 2.29% and 0.43% of total summer fruit productive area and contributed 3.48%, 1.96%, 3.37%, 1.75%, 6.51%, 0.70% and 0.59% of total summer fruit production respectively (Table 8).

***Winter Fruits***

Increment in productive area is greater compared to production of winter fruits and sharp decline in the productive area and production of winter fruit was observed during the year 2016/17 (Fig. 6). Average productivity of winter fruits for the time period of 10 year from 2009/10 to 2018/19 is 7.58Mt $ha^{-1}$. The yield is below average in the year 2013/14, 2015/16, 2016/17, 2017/18 and 2018/19 which is 7 Mt $ha^{-1}$, 7.4 Mt $ha^{-1}$, 6.7 Mt $ha^{-1}$, 7.2 Mt $ha^{-1}$ and 7.27 Mt $ha^{-1}$ respectively. The yield is above average in the year 2009/10, 2010/11, 2011/12, 2012/13, 2014/15 which is 8.6 Mt $ha^{-1}$, 8 Mt $ha^{-1}$, 8.1 Mt $ha^{-1}$, 7.9 Mt $ha^{-1}$, and 7.6 Mt $ha^{-1}$ respectively. The percentage increase in area, productive area, production and decrease in productivity of the winter fruits in 2018/19 compared to 2009/10 is 30.50%, 26.28%, 7.31% and 11.89% respectively.

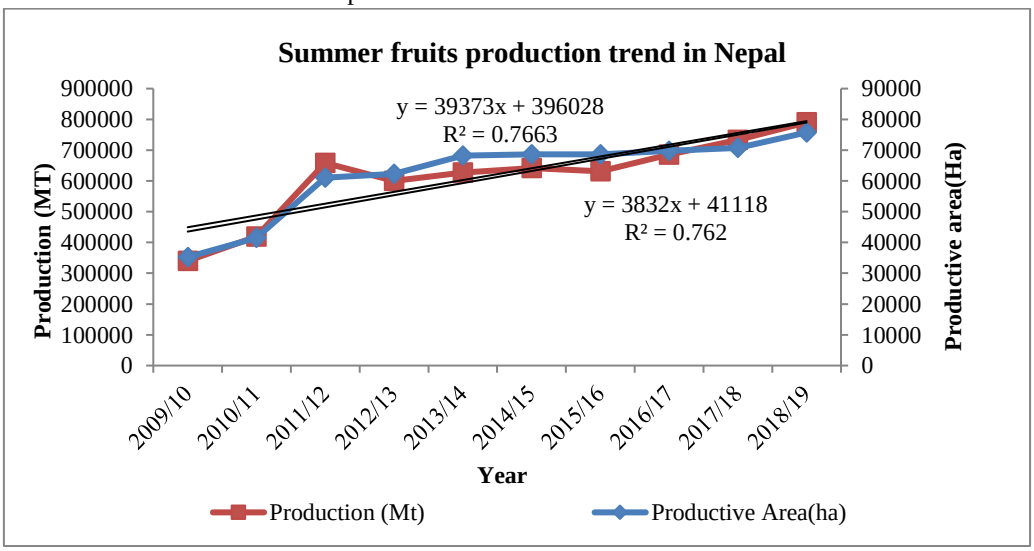


**Fig. 5**: Summer fruits production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 8**: Overall scenario of summer fruits production in Nepal (2018/19)

| Summer Fruits | Area(ha) | Productive Area(ha) | Production (Mt) | Yield (Mt $ha^{-1}$) |
|---|---|---|---|---|
| Mango | 49588 | 42461 | 366144 | 8.62 |
| Banana | 18329 | 16615 | 278890 | 16.79 |
| Guava | 3693 | 3070 | 27541 | 8.97 |
| Papaya | 1528 | 1227 | 15525 | 12.65 |
| Jackfruit | 2707 | 2268 | 26651 | 11.75 |
| Pineapple | 1149 | 981 | 13846 | 14.12 |
| Litchi | 9314 | 7054 | 51475 | 7.3 |
| Arecanut | 2127 | 1737 | 5542 | 3.19 |
| Coconut | 366 | 327 | 4675 | 14.29 |
| **Total** | **88801** | **75740** | **790289** | **10.43** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

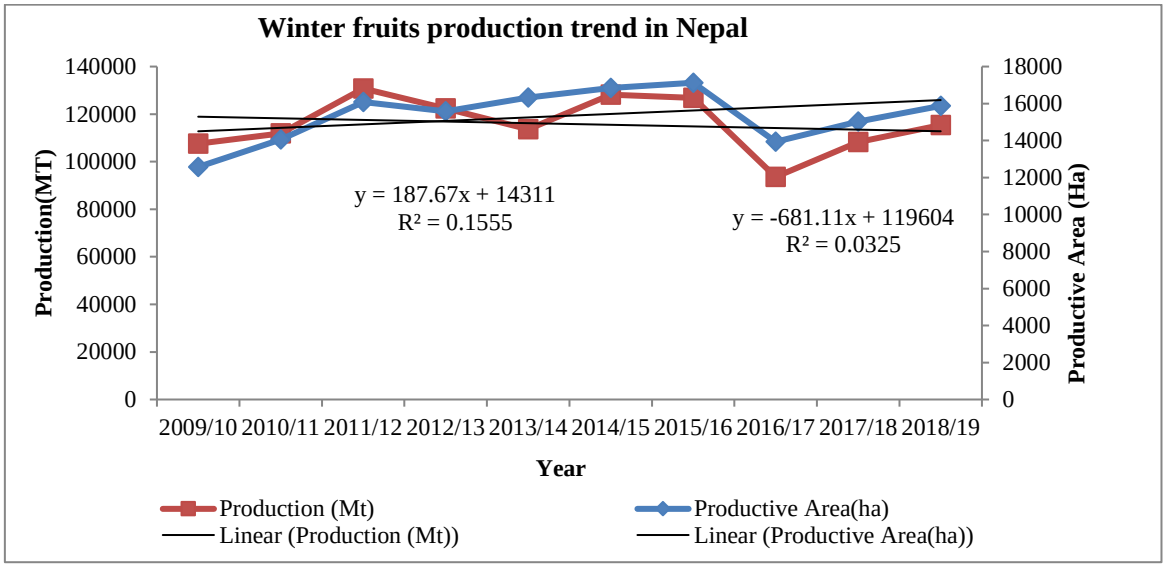


**Fig. 6**: Winter fruit production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 9**: Overall scenario of winter fruit production in Nepal (2018/19)

| Winter fruits | Area (ha) | Productive Area (ha) | Production (Mt) | Yield (Mt ha$^{-1}$) |
|---|---|---|---|---|
| Apple | 11186 | 4349 | 31386 | 7.22 |
| Pear | 4275 | 3338 | 32025 | 9.6 |
| Walnut | 5037 | 2167 | 8934 | 4.12 |
| Peach | 2232 | 1735 | 12039 | 6.94 |
| Plum | 1908 | 1441 | 10375 | 7.2 |
| Apricot | 471 | 305 | 1923 | 6.29 |
| Persimmon | 571 | 385 | 3085 | 8.02 |
| Pomegranate | 892 | 594 | 3653 | 6.15 |
| Hog Plum | 1476 | 1072 | 8651 | 8.07 |
| Kiwi | 1362 | 492 | 3372 | 6.86 |
| **Total** | **29410** | **15877** | **115443** | **7.27** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

During the fiscal year 2018/19, winter fruits were grown under 17.86% of total fruit growing area, 13.22% of total productive area and production share by winter fruits was 9.80% of total fruit production. Winter fruits mainly grown in Nepal are Apple, Pear, Walnut, Peach, Plum, Apricot, Persimmon, Pomegranate, Hog Plum and Kiwi. Apple and pear shared 27.39% and 21.02% of total winter fruits productive areas and 27.19% and 27.74% of total winter fruit production in Nepal, respectively. Walnut, peach, plum and hog plum occupied 13.65%, 10.93%, 9.08% and 6.75% of total winter fruits productive areas respectively, and contributed 7.74%, 10.43%, 8.99% and 7.49% of total winter fruit production in Nepal respectively (Table 9).

***Citrus Fruits***

The productive area and production of Citrus fruits in Nepal is in increasing trend but the production started to decline after 2011/12 due to which the productivity of citrus fruits decreased from 2011/12 to 2015/16. The production and productivity of citrus fruits again started to increase after 2015/16 (Fig.7). The increment in areas of citrus fruits is greater than increment in production which has led to decrease in productivity in recent years. The average productivity of citrus fruit for 10-year time period from 2009/10 to 2018/19 is 9.6Mt ha$^{-1}$. The yield is above average in the year 2009/10, 2010/11, 2011/12 which is 11.3 Mt ha$^{-1}$, 11.2 Mt ha$^{-1}$ and 10 Mt ha$^{-1}$ respectively. The yield is below average in the year 2012/13, 2013/14, 2014/15, 2015/16, 2016/17, 2017/18 and 2018/19 which is 9.1 Mt ha$^{-1}$, 8.8 Mt ha$^{-1}$, 8.8 Mt ha$^{-1}$, 8.8 Mt ha$^{-1}$, 9 Mt ha$^{-1}$, 9.4 Mt ha$^{-1}$ and 9.57 Mt ha$^{-1}$ respectively. The percentage increase in area, productive area, production and decrease in productivity of the citrus fruits in 2018/19 compared to 2009/10 is 36.92%, 24.02%, 4.9% and 15.30% respectively.

During the fiscal year 2018/19, citrus fruits shared 28.19%, 23.67% and 23.09% of total fruit cultivation area, total fruit productive area and total fruit production of Nepal respectively. Mandarin, sweet orange, lime and lemon are the citrus fruits grown in Nepal. Mandarin alone shared 60.62% of total citrus fruits productive area and 65.24% of total citrus fruit production. Sweet orange, lime, lemon and other citrus fruits share 14.19%, 19.85%, 2.70%, 2.64% of total citrus fruit productive areas and contributed 15.84%, 14.56%, 2.23% and 2.14% of total citrus fruit production in Nepal respectively (Table 10).

***Vegetables***

Average productivity of vegetable for 10-year time period from 2009/10 to 2018/19 is 13.53Mt $ha^{-1}$. The total yield is below average in the year 2009/10, 2010/11, 2011/12, 2012/13, 2013/14, 2014/15 and 2016/17 which is 12.78Mt $ha^{-1}$, 13.12Mt $ha^{-1}$, 13.46 Mt $ha^{-1}$, 13.40 Mt $ha^{-1}$, 13.42 Mt $ha^{-1}$, 13.41 Mt $ha^{-1}$ and 13.52 Mt $ha^{-1}$ respectively. The yield is above average in the year 2015/16, 2017/18 and 2018/19 which is 13.99 Mt $ha^{-1}$, 13.80 Mt $ha^{-1}$ and 14.37 Mt $ha^{-1}$ respectively. During the fiscal year 2018/19, vegetable was cultivated in total area of 297195 ha with total production of 4271270 Mt and 14.37 Mt $ha^{-1}$ total yields.

The area and production under vegetable production is continuously increasing since 2009/10 but production decline was observed in 2016/17. Production has increased after 2016/17 and increment in production of vegetable is greater compared to increment in area (Fig.8). The improved access to seeds and fertilizers, agricultural credit, training and extension services, favorable climatic conditions, improved crop management practices, and increased in mechanization in vegetable farming with area expansion has led to increased productivity of vegetables. Increment in the efficiency of vegetable farming helps to increase per capita income, pave way out of poverty trap and improve livelihood of small holder farmers. The percentage increase in area, production and productivity of vegetables in 2018/19 compared to 2009/10 is 26.41%, 42% and 12% respectively.

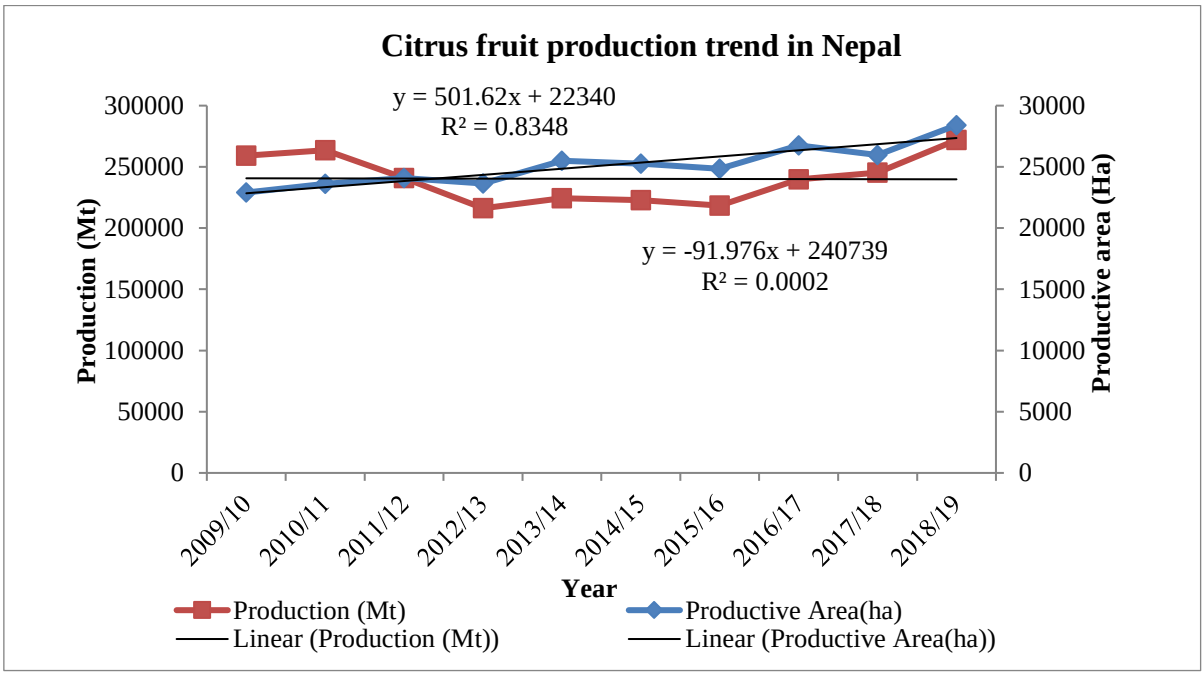


**Fig. 7**: Citrus fruit production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

**Table 10**: Overall scenario of citrus fruits production in Nepal (2018/19)

| Citrus fruits | Area (ha) | Productive Area (ha) | Production (Mt) | Yield (Mt $ha^{-1}$) |
|---|---|---|---|---|
| Mandarin | 27951 | 17220 | 177381 | 10.3 |
| Sweet orange | 6646 | 4031 | 43061 | 10.68 |
| Lime | 9558 | 5638 | 39580 | 7.02 |
| Lemon | 1114 | 768 | 6075 | 7.91 |
| Others | 1142 | 749 | 5811 | 7.76 |
| **Total** | **46411** | **28406** | **271908** | **9.57** |

[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

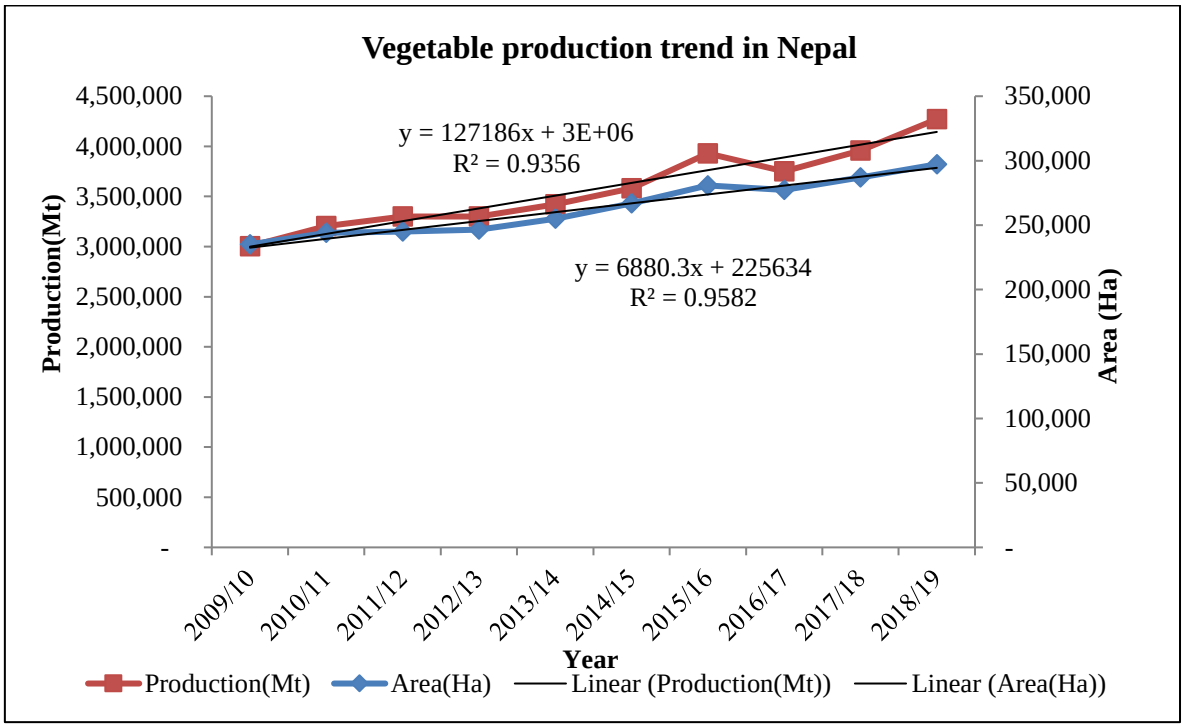


**Fig. 8**: Vegetable production trend in Nepal
[Source: MoALD (2020), Statistical Information on Nepalese Agriculture, 2018/19]

## Conclusion

The percentage increment in production of cereal and cash crops is greater compared to area which is due to availability of irrigation facilities, use of improved and hybrid seeds, availability of chemical fertilizers and technological knowledge among the farmers. There is only 1% increase in area under paddy cultivation whereas there is decrease in area under wheat, millet and barley cultivation in 2018/19 compared to 2009/10. Cash crop farming over time remains as a viable means of increasing income, ensuring security of small holder farmers, improves food security along with sustainable agricultural development. There is percentage increment in area, production and productivity of oilseed, potato and sugarcane whereas percentage decrease in area and production of jute and cotton was observed in 2018/19 in comparison to 2009/10. The technological innovations and use of high yielding varieties has played a major role to increase production of pulses in Nepal. Among pulses, the winter crop lentil dominates in production (65.76%) as well as in area coverage (62.93%). We can say that lentil will continue to dominate in future as well since lentil is prioritized by Agricultural Development Strategy 2015-2035 in Nepal. There is greater increment in areas of fruits compared to production due to which there is 2% decrease in productivity of fruits in 2018/19 compared to 2009/10.There is greater increment in production of summer fruits than area whereas there is greater increment in areas compared to production in case of winter fruits and citrus fruits. Mango and banana share 78% of total summer fruit productive areas and contributes 81.62% of total summer fruit production. Mandarin alone shares 60.62% of total citrus fruits productive area and 65.24% of total citrus fruit production. Apple and pear share 48.41 % of total winter fruits productive areas and contributes 54.93 % total winter fruit production in Nepal. Increase in production of fruits and vegetables is attributed to favorable climatic conditions, improved crop management practices, availability of seeds, fertilizers and planting stocks, access to agricultural credit and increased mechanization with expansion of area under vegetable and fruit farming. Increment in the efficiency of vegetable farming helps to increase per capita income, pave way out of poverty trap and improve livelihood of small holder farmers. This study provides an overview of agriculture production scenario in Nepal. Government needs to focus on this issue and prioritize further research and development in agriculture sector.

## Conflict of Interest

The author declares that there is no conflict of interest with present publication.

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