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Trend in Area, Production and Productivity of Pigeon Pea in Myanmar

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ABSTRACT

Background: Pigeon pea (*Cajanus cajan*) is the third most important pulse crop of Myanmar. The country is the biggest exporter of pigeon pea accounting for nearly (90%) of the total global export volumes. This study evaluates trends in the area, production and productivity of pigeon pea in Myanmar.

Methods: The study is based on 10 years (2008 to 2017) secondary data obtained from the Myanmar MOALI and FAOSTAT. CAGR and multiple regression were adopted as the study methods.

Result: Results indicated that due to an increase in harvesting area and productivity, pigeon pea production increased from 7,65,000 MT in 2008 to 7,98,689 MT in 2017. However, CAGR indicated a nonsignificant decrease.

Key words: Area, CAGR, Myanmar, Pigeon pea, Production, Trend.

INTRODUCTION

Pigeon pea (*Cajanus cajan*) is an important multi-use shrub legume of the tropical and sub-tropical regions. Historically the crop is believed to have originated from India and moved to Africa about 4,000 years ago and now it is the second most important Kharif grain legume after chickpea in India and grown predominantly under rainfed conditions (Sarkar *et al*., 2020). It is the preferred pulse crop in dryland areas where it is inter-cropped or grown in mixed cropping systems with cereals or other short-duration annuals (Joshi *et al*., 2001). The seed is made up of 85 per cent cotyledon, 14 per cent seed coat and about 1 per cent embryo. It is a rich source of protein, carbohydrates, minerals and vitamins. It also contains a good amount of minerals (iron 5.8 mg, Calcium 73 mg and phosphorus 304 mg per 100 g). Pigeon pea pods are consumed as green vegetables in many countries. Dry seeds of pigeon pea are consumed as split dhal, the crop is also used as feed for milch cattle. Green leaves from plants are used as fodder: in recent years its use as a fodder crop has increased (Jeevarathinam and Chelladurai, 2020). The non-nutritive compounds of the crop have been studied for their role in the enhancement of the antioxidant and anti-carcinogenic effects and recent studies found that pigeon pea bioactive elements play a vital role in modulating the gut microbiota that can reduce inflammation (Talari and Shakappa, 2018). Besides its nutritional benefits, the crop is also used as traditional folk medicine in India, Philippines, China and other Asian countries. Additionally, pigeon pea is used to treat several illnesses such as respiratory, coughs, bronchitis, infection, dysentery, pneumonia, wounds, sores, menstrual disorders, abdominal tumours, diabetes and toothache (Saxena *et al*., 2010).

Among the legumes, pigeon pea occupied an important place in rain-fed agriculture. The crop was globally cultivated on 4.79 m ha in 22 countries in 2010 with only a few major producers. In Asia, India (3.58 m ha), Myanmar (560,000 ha) and Nepal (20,703 ha) were important pigeon pea-producing countries (Saxena *et al*. 2002). India was considered to be the largest producer of pulses in the world with a 24 per cent share in global production. Important pulse crops reported were chickpea, pigeon pea, mung bean, urad bean, lentil and field pea in the country (Masood and Gupta, 2012).

The highest levels of pigeon pea per capita consumption were reported in Malawi (22.35 kg/year), followed by Myanmar (11.02 kg/year), Kenya (6.72 kg/year) and Tanzania (5.16 kg/year) (Majili *et al*., 2020). It is the fourth most important pulse crop in the world with almost all production confining to developing countries (97%) of the world. Asia accounts for 83 per cent and Africa contributes 14 per cent (Shivhare, 2013). According to FAO statistics, India was the world's largest producer in 2018 with about 4.29 Mt and from an area of about 6.22 Mha. In the same year, India contributed about 71.97 per cent of the global production and 79.84 per cent to the global area with 768kg/ha productivity. The other major pigeon pea-producing countries are Myanmar (11.34%), Malawi (7.29%), Tanzania (5.30%), Haiti (1.47%) and Kenya (1.47%) (FAOSTAT, 2018). The trends in the area, production and yield of chickpea reveal that developing countries dominate in area and production of chickpea and these measures also grew sharply since the mid-1990s, led by new niches of production in Africa, South-eastern Asia and growth in traditional growing countries like India (Joshi *et al*., 2016).

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While many researchers quantified the production and area harvested of pigeon pea and explained the underlying reasons behind the trends of the crop but, few researchers emphasized the Myanmar case. Since Myanmar is the second-largest producer of the crop in the world, it is necessary to evaluate the trend in area and production of this important crop and explain the main reasons behind these trends. This attempt would help researchers, organizations and institutions to have a better understanding of the growth trend in the area, production and productivity of pigeon pea and also facilitate researchers to modify and improve the method of enhancing pigeon pea production.

MATERIALS AND METHODS

Sources of the data

The study was conducted between February and July of 2019 in the department of agricultural marketing, co-operation and business management, university of agricultural sciences, Bangalore, India. This study is based on secondary data which was conducted in 2019. Time series Figs and records on the area, production and productivity of pigeon pea for ten years (2008-17) were collected from FAOSTAT. Additionally, state-wise and division-wise production of the crop was obtained from the Ministry of Agriculture, Livestock and Irrigation (MOALI) of Myanmar.

Analytical tools and techniques

The analytical tools used in this study are descriptive statistics, compound annual growth rate analysis (CAGR). Lastly, regression analysis was applied to examine the significance of CAGR.

Compound annual growth rate analysis

The time-series data on the area and production of pigeon pea in Myanmar was analysed using the CAGR model as shown in equation 1:

$$Y_t = AB^t u_t \quad (1)$$

Where,

Y_t = Area (production) during time t
A = Constant
t = Time period
u_t = Error term
B = (1+g), where g = growth rate

By taking the logarithm, equation (1) was reduced to the following form.

$$\text{Log } Y_t = \text{Log } A + t(\text{Log } B) + \text{Log } u_t \quad (2)$$

Where,

Log A and log B were the parameters of the function obtained by the ordinary least square (OLS) method. Once the above equation is estimated, g can be computed as:

$$g = [\text{Antilog } (B)-1] \times 100 \quad (3)$$

RESULTS AND DISCUSSION

The growth in area, production and productivity of pigeon pea in major states and divisions of Myanmar were computed with the help of CAGR analysis. Beans and pulses in Myanmar are normally grown immediately after the harvest of the main rice crop in the delta region (lower parts of Myanmar) and as a monsoon crop in the central plain areas and Shan State (East part of the country) (MOALI, 2016). The detailed results are presented in the following paragraphs.

Trend in area and production of pigeon pea in Myanmar

The area, production and productivity of pigeon pea for ten years period from 2008-17 are presented in (Table 1). It reveals that the harvested area of pigeon pea has increased from 6,11,481 ha in 2008 to 6,58,101 ha in 2017 registering a CAGR of 0.76 per cent. Similar to the area increase under pigeon pea for the reference period, production increased from 7,65,000 MT in 2008 to 7,98,689 MT in 2017. However, CAGR indicated a nonsignificant decrease. The Cyclone Nargis in 2008 and the negative effects of the disaster remained until 2011-2015 which caused the decrease in the production of the crop. Additionally, the decrease in production was also due to extreme weather (rains at the flowering stage of the crop) and instability of production of pigeon pea in minor states and divisions. The area and production of pigeon pea trends in Myanmar are also illustrated in (Fig 1).

1- Area, production and productivity of pigeon pea in major states and divisions of Myanmar

Myanmar comprises seven states and seven divisions Therefore, the performance of pigeon pea in some popular states and divisions are presented in the following section.

Table 1: Trend in area, production and productivity of pigeon pea in Myanmar.

Year	Area/ha	Production (MT)	Productivity (kg/ha)
2008	6,11,481	7,65,000	1251
2009	6,16,337	7,60,600	1234
2010	6,32,929	8,24,200	1302
2011	6,43,046	5,80,100	902
2012	6,12,695	5,49,000	896
2013	6,38,595	5,78,800	906
2014	6,18,765	5,75,100	929
2015	6,46,688	6,02,303	931
2016	6,68,216	6,27,600	939
2017	6,58,101	7,98,689	1214
CAGR (%)	0.76**	-1.50^{NS}	-2.25^{NS}

Source: FAOSTAT.

Note: **Statistically significant at 5% level.

^{NS}Not significant.

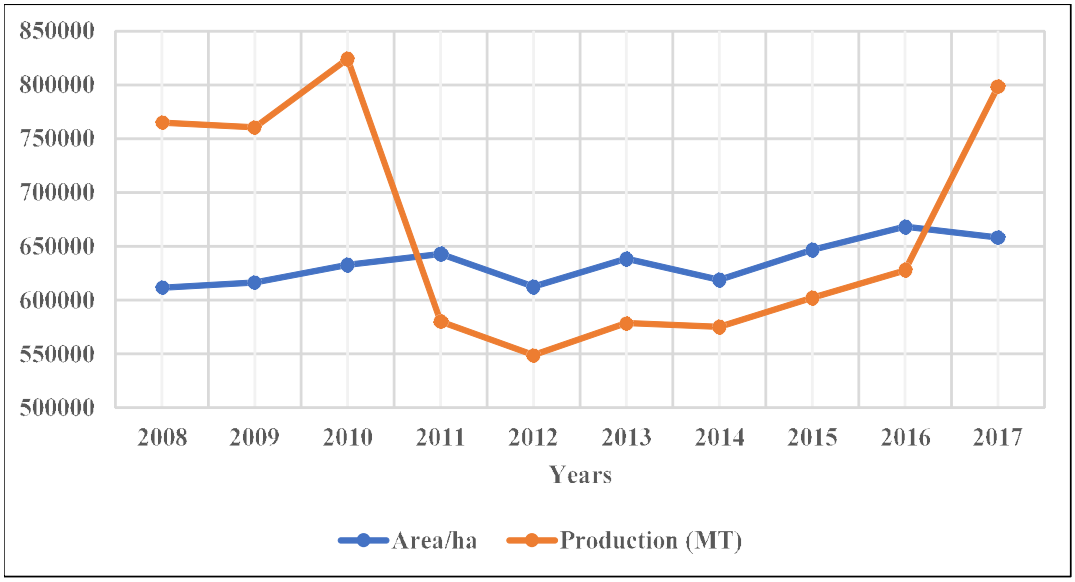

Fig 1: Area and production trend of pigeon pea in Myanmar.
Source: FAOSTAT.

1-1- Trend in area, production and productivity of pigeon pea in the Shan state of Myanmar

The trend in the area, production and productivity of pigeon pea for ten years in the Shan State of Myanmar is depicted in Table 2. The area harvested as indicated in the table increased marginally from 26,373 hectares in 2008 to 30,080 hectares in 2017 and registered 0.99 per cent CAGR. Though the harvested area increased marginally in ten years, the CAGR of production (1.18%) indicated a higher per centage than the area harvested. The reason was mainly due to an increase in the area rather than productivity and the nature of cultivated land in the state. Most of the Shan State is a hilly plateau with clay-loamy soil which is in favour of pigeon pea cultivation (Saxena and Singh, 2021). Additionally, Shan state borders China to the north, Laos to the east and Thailand which has emerged as an international market of pigeon pea trade. The growth in area and production were statistically significant at 5 per cent level and 1 per cent level, respectively.

1-2- Trend in area, production and productivity of pigeon pea in Sagaing Division of Myanmar

Area, production and productivity of pigeon pea for ten years in the Sagaing division are presented in Table 3. As the table indicates, harvested area (hectare) of pigeon pea in the Sagaing division increased slightly from 2,11,989 to 2,44,543 ha during 10 years time period registering a CAGR of 1.79 per cent, which is statistically significant at 1 per cent level. Accordingly, the productivity of pigeon pea also increased in the division from 3,03,791 MT in 2008 to 3,54,820 MT in 2017. The production growth rate was 2.26 per cent per annum which is statistically significant (at 1% level) while the productivity growth was significant at 10 per cent level. Pigeon pea is cultivated by almost all farmers in the Sagaing state as a commercial crop to earn income for agricultural operations, staple foods along with other household needs (Moe and Nwata, 2014).

1-3- Trend in area, production and productivity of pigeon pea in Mandalay Division of Myanmar

The area, production and productivity of pigeon pea in Mandalay division for ten years period from 2008-17 is presented in Table 4. Harvested area of pigeon pea has increased from 186,091 ha to 1,97,865 ha during the period which registered 0.13 per cent CAGR. Though the harvested area under pigeon pea increased for the reference period, production indicated negative CAGR due to a decline in

Table 2: Trend in area, production and productivity of pigeon pea in Shan State of Myanmar.

Year	Area (hectare)	Production (MT)	Productivity (kg/ha)
2008	26,373	34,290	1300
2009	27,353	35,967	1315
2010	27,196	35,589	1309
2011	28,616	36,325	1269
2012	29,364	37,914	1291
2013	29,463	38,199	1,296
2014	28,319	37,108	1310
2015	27,568	36,477	1323
2016	28,987	38,203	1318
2017	30,080	39,723	1321
CAGR (%)	0.99**	1.18***	0.18^{NS}

Source: Ministry of Agriculture, Livestock and Irrigation.
Note: **Significant at 5% level.
***Statistically significant at 1% level.
^{NS}Not significant.

productivity (-0.6% CAGR) of local varieties that took longer duration (more than 200 days) for maturity and hence damaged by seasonal rains. Irregularity of weather is the next reason behind the lower productivity of pigeon pea in the Mandalay division. In 2008 total production in the Mandalay division was 2,00,476 MT which was reduced to 1,73,298 MT by 2012. This was due to unfavourable weather conditions and excessive rainfall during the flowering stage of the crop (Lay *et al*., 2016).

1-4- Trend in area, production and productivity of pigeon pea in Magwe Division of Myanmar

The GAGR of pigeon pea area, production and productivity in Magwe Division for the period 2008-17 is presented in Table 5. It is evident that area (1,70,243 to 1,79,938 ha), production (2,10,335to 2,70,195 MT) and productivity (1236 to 1502 kg/ha) registered positive growth of 0.19, 0.85 and 0.65 per cent per annum respectively for the period however, the growth rates were not significant statistically. Soil and weather are suitable for the cultivation of pigeon pea in Magwe which has turned the state into one of the most stable producers of the crop. Another advantage associated with the growth of the crop in this division is red colour pigeon pea production which is used primarily for exports and there is positive demand in the national and international markets. There was a consistent demand in international markets during the years of 2008-16 which led to a persuasion of traders and farmers to cultivate and produce the crop. But in past years due to trade barriers from importer countries (*e.g*., India) production has reduced slightly.

Table 3: Trend in area, production and productivity of pigeon pea in Sagaing Division of Myanmar.

Year	Area (ha)	Production (MT)	Productivity (kg/ha)
2008	2,11,989	3,03,791	1433
2009	2,08,074	2,98,841	1436
2010	2,20,739	3,18,727	1444
2011	2,21,856	3,23,039	1456
2012	2,14,057	3,13,052	1462
2013	2,27,884	3,34,230	1467
2014	2,25,760	3,37,435	1495
2015	2,37,680	3,54,241	1490
2016	2,45,554	3,73,867	1523
2017	2,44,543	3,54,820	1451
CAGR (%)	1.79***	2.26***	0.46*

Source: Ministry of Agriculture, Livestock and Irrigation.
Note: ***Statistically significant at 1% level.
*Significant at 10% level.

Table 4: Trend in area, production and productivity of pigeon pea in Mandalay Division of Myanmar.

Year	Area (ha)	Production (MT)	Productivity (kg/ha)
2008	1,86,091	2,00,476	1077
2009	1,90,900	1,97,019	1032
2010	1,95,234	2,10,802	1080
2011	1,98,400	2,10,676	1062
2012	1,76,539	1,73,298	982
2013	1,88,117	1,88,103	1000
2014	1,70,823	1,75,384	1027
2015	1,86,490	1,91,145	1025
2016	1,98,796	2,06,924	1041
2017	1,97,865	1,96,790	995
CAGR (%)	0.13^{NS}	-0.47^{NS}	-0.60 ^{NS}

Source: Ministry of Agriculture, Livestock and Irrigation.
Note: ^{NS}Not significant.

Table 5: Trend in area, production and productivity of pigeon pea in Magwe Division of Myanmar.

Year	Area (ha)	Production (MT)	Productivity (kg/ha)
2008	1,70,243	2,10,335	1236
2009	1,73,422	2,13,444	1231
2010	1,74,078	2,43,843	1401
2011	1,76,858	2,48,362	1404
2012	1,76,865	2,51,216	1420
2013	1,77,850	2,58,316	1452
2014	1,76,864	2,61,297	1477
2015	1,79,568	2,69,614	1501
2016	1,79,938	2,70,195	1502
2017	1,68,474	1,89,801	1127
CAGR (%)	0.19^{NS}	0.85^{NS}	0.65^{NS}

Source: Ministry of Agriculture, Livestock and Irrigation.
Note: ^{NS} Not significant.

CONCLUSION

In summary, it is concluded that; the harvested area of the major state and divisions which were computed with the help of CAGR increased during the years 2008-17 and were 0.99 and 1.79 per cent respectively for Shan state and Sagaing division.

The production in the Mandalay division registered a negative CAGR (-0.47%) for the period 2008-17. While the production growth of Shan state and Sagaing division increased during the mentioned period and its CAGR registered a positive per centage of 1.18 and 2.46 in that order.

Productivity of the crop in Mandalay division registered a negative CAGR of (-0.60%) for 2008-17. However, Sagaing division productivity registered a positive CAGR of 0.46 per cent.

The productivity of pigeon pea is decreasing in the Mandalay division over the past years due to the lower input use, sensitive and aberrant weather and climatic abnormalities. Hence, it is required to introduce high-yielding varieties to increase productivity and production in the

division. Red pigeon pea is mainly exported to the international markets which calls for encouraging the production of red pigeon pea by popularising drought-tolerant varieties.

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