

Research Paper

Trends in Area, Production and Productivity of Wheat Cultivation at Global Level

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Received: 10-03-2022

Revised: 23-08-2022

Accepted: 05-09-2022

ABSTRACT

The present study was conducted on trend analysis of wheat production in India and Afghanistan. The study was based on secondary data collected from various published and unpublished sources in India, Afghanistan and at the global level from 2000-19. The present study was undertaken to know the growth rate in area, production and productivity of wheat in India and Afghanistan which were found positive during 2019-20. The findings of this study have far-reaching implications that will have a significant impact on the planning, execution, and design of appropriate methodologies in order to achieve meaningful and fruitful demonstration results not only for wheat growers, but also for other sectors that essentially provide feedback to agencies involved in various demonstration programmes. It explicitly emphasises the relevance of frontline demonstration in increasing farmer production, returns and reduce the extension and technology gap.

HIGHLIGHTS

- Compound Growth Rate of area, production and productivity of wheat was higher in Afghanistan compared to India.

Keywords: Frontline Demonstration, Returns, Productivity, Extension and Technological Gap

Cereals play an important role to satisfy the demand of food for increasing population, particularly in developing countries where cereal-based production system is the only predominant source of nutrition and calorie intake. The nutria-rich cereal is grown in diversified environments; globally wheat is cultivated in around 215.91 million hectares (highest acreage among all crops) with an annual production of around 765.77 million tonnes. Being one of the principal cereal crops, Wheat is grown worldwide and one of the important staples of around 205 billion of the world population. Wheat provides almost half of all calories in the region of North Africa and West and Central Asia. Being next to rice, wheat constitutes one of the key sources of protein in the least developed countries and middle-income

nations in terms of calories and dietary intake. Wheat is cultivated as a winter and spring crop in the world, winter wheat is grown in cold countries like Europe, the USA, Australia, Russian Federation, etc., while spring wheat is grown in Asia and some parts of the USA (Ramadas *et al.* 2019).

MATERIALS AND METHODS

The present study was based on secondary data related to the area, production, and productivity of wheat collected for the period 2000-2019 from

How to cite this article: Bahaudin, S., Kumar, N., Kumar, D., Kumar, V. and Ritu. (2022). Trends in Area, Production and Productivity of Wheat Cultivation at Global Level. *Econ. Aff.*, 67(04): 401-406.

Source of Support: None; **Conflict of Interest:** None



different sources such as the FAOSTAT, INDIA STAT, APEDA, DES, NSSO, CSO, GOI, New Delhi., Govt. of Haryana, Statistical Abstracts, Ministry of Agriculture Afghanistan and various other published and unpublished sources.

Growth rate analysis

The growth in the area, production and productivity of wheat were computed for the period of 2000-2019 for India as well as Afghanistan. To calculate compound growth rates in the area, production and productivity of wheat the exponential function will be used:

$$Y_t = ab^t e^u \quad \dots(1)$$

Where,

Y_t = area/ production /productivity

t = time period (in years)

a = Intercept value (value of y when $t = 0$)

$b = (1 + r)$, ' r ' being the growth rate

e = Error term

After log transformation of equation (1);

$$\text{Log } Y_t = \text{Log } a + t * \text{Log } b$$

And Compound Annual Growth Rate (CAGR) is given by:

$$\text{CAGR } (\%) = \{ \text{Antilog } (\text{Log } b) - 1 \} * 100$$

Where,

b = antilog of slope of area/ production/ productivity

RESULTS AND DISCUSSION

Area, production and productivity of wheat in prominent countries

Table 1 reveals that India, Russian Federation, China, USA, Kazakhstan, Australia, Canada, Pakistan, Iran and Turkey are the leading wheat-producing countries. India ranked 1st in the area under cultivation (29.32 million hectares) and 2nd (103.60 million tonnes) in terms of production, while at global level China ranked 1st in production (133.60 million tonnes) and 3rd (23.73 million hectares) in the area under wheat cultivation.

The results concluded that Ireland and Netherlands are leading countries in wheat productivity with the average yield of 9378.70 kg/ha and 9378.10 kg/ha respectively. Whereas among the leading wheat producing country India ranked with 42nd due to lower wheat productivity *i.e.* 3533.4 kg ha⁻¹ at global level. While Afghanistan with average productivity of 2096 kg/ha is placed with 80th position at global level presented in table 2. India and Afghanistan needs improvement in productivity through quality seeds, improvement of soil health, balance use of fertilizer, plant protection measures and use of resource conservation technology.

India and China are the leading countries in terms of area and production respectively in the Asian continent (Table 3). In Africa continent, Morocco is leading in area under cultivation of wheat while Egypt ranked 1st in production and productivity at the continent level. The USA is a leading country in the area and production of wheat while, Mexico ranked 1st in productivity in the American continent. In Europe continent, Russia ranked 1st in the area and production, while Ireland and Netherlands are the leading countries in productivity of wheat at the continent as well as at the global level. The results analyzed that the area and production in Asian countries are higher but productivity is low and need improvement in productivity through the improved in agricultural technology. The results obtained are in conformity with the earlier study conducted by Phillips and Norton (2012).

The global wheat area was 214.94 Mha in the year 2000 which slightly increased to 215.91 Mha in the year 2019. The total production was 585 Mt in the year 2000 which significantly increased to 765.77 Mt in the year 2019, whereas, the average productivity of wheat increased from 2722 kg/ha in the year 2000 to 3547 kg/ha in the year 2019. The compound annual growth rate of wheat for area, production and productivity were found 0.12, 1.63 and 1.52 per cent per annum, respectively during the period 2000-2019 (Table 4). The major source of increase in total production was mainly attributed to increase in productivity followed by slight increase in area. While increase in productivity was due to use of high yielding varieties, fertilizer and adoption of other improved technologies of wheat cultivation. Similar results were obtained by Ramdas *et al.* (2019) in their study.

Table 1: Area, production and productivity of wheat in prominent countries (2019)

Country	Area (Mha)	% share of total area	Production (Mt)	% share of total Production	Productivity (kg/ha)
India	29.32	13.58	103.60	13.53	3533.4
Russian Federation	27.56	12.76	74.45	9.72	2701.6
China	23.73	10.99	133.60	17.45	5629.4
USA	15.04	6.97	52.60	6.87	3474.8
Kazakhstan	11.41	5.28	11.30	1.48	989.7
Australia	10.4	4.82	17.59	2.30	1691.7
Canada	9.66	4.47	32.35	4.22	3350.2
Pakistan	8.68	4.02	24.35	3.18	2805.9
Iran	8.04	3.72	16.80	2.19	2090.6
Turkey	6.83	3.16	19.00	2.48	2781.1
Afghanistan	2.33	1.08	4.89	0.64	2095.1
World	215.91	100.00	765.77	100	3543.2

Table 2: Leading countries with high productivity of wheat at global level in year 2019

Country	Productivity (kg/ha)	Rank
Ireland	9378.70	1
Netherlands	9378.10	2
Belgium	9336.40	3
UK and Northern Ireland	8934.50	4
New Zealand	8846.50	5
Denmark	8095.70	6
France	7742.80	7
Sweden	7405.50	8
Germany	7396.40	9
Zambia	6687.70	10
India	3534	42
Afghanistan	2096	80
World Average	3547	

Table 3: Area, production and productivity of wheat in various continent of the world during year 2019

Continent	Country	Area (Mha)	Production (Mt)	Yield (Kg/ha)
Asia	China	23.73	133.60	5,630
	India	29.32	103.60	3,533
	Pakistan	8.68	24.35	2,806
	Iran	8.04	16.80	2,091
	Kazakhstan	11.41	11.30	990
Africa	Egypt	1.41	9.00	6,379
	Ethiopia	1.79	5.32	2,971
	Morocco	2.51	4.03	1,606
	Algeria	1.97	3.88	1,963
	Tunisia	0.64	1.44	2,240
America	USA	15.04	52.26	3,475
	Canada	9.66	32.35	3,350
	Argentina	6.05	19.46	3,216
	Brazil	2.10	5.60	2,671
	Mexico	0.59	3.24	5,531
Europe	Russia	27.56	74.45	2,702
	France	5.24	40.60	7,743
	Ukraine	6.83	28.37	4,157
	Germany	3.12	23.06	7,396
	Poland	2.51	10.81	4,304
Australia	Australia	10.40	17.60	1,692
	New Zealand	0.05	0.40	8,847

*Leading five countries of each continent were included, Mha = Million hectare, Mt = Million tonnes.

Table 4: Trends in area, production and productivity of wheat in the world during period 2000-2019

Sl. No.	Year	Area (Mha)	Production (Mt)	Yield (kg/ha)
1	2000	214.94	585.00	2722
2	2001	214.56	588.25	2742
3	2002	214.9	592.05	2756
4	2003	207.43	549.98	2652
5	2004	215.68	634.67	2943
6	2005	221.67	627.03	2829
7	2006	212.56	614.39	2891
8	2007	215.45	606.6	2816
9	2008	222.14	680.3	3063
10	2009	225.2	683.64	3036
11	2010	215.61	640.81	2973
12	2011	220.27	696.9	3164
13	2012	217.92	673.73	3092
14	2013	218.88	710.4	3246
15	2014	219.76	728.76	3317
16	2015	223.42	742.03	3322
17	2016	219.02	748.5	3418
18	2017	218.3	772.3	3538
19	2018	213.99	733.39	3428
20	2019	215.91	765.77	3547
CAGR %		0.12 ^{NS}	1.63 ^{***}	1.52 ^{***}

Note: Mha = Million hectare, Mt = Million ton, ***-Significant at 10 % level, NS-Not Significant

Table 5: Trends in area, production and productivity of wheat in India during period 2000-2019

Sl. No.	Year	Area (Mha)	Production (Mt)	Yield (kg/ha)
1	2000	27.49	76.37	2779
2	2001	25.74	69.69	2709
3	2002	26.35	72.77	2763
4	2003	25.2	65.77	2610
5	2004	26.6	72.16	2714
6	2005	26.39	68.64	2602
7	2006	26.49	69.36	2619
8	2007	28.00	75.81	2708
9	2008	28.04	78.58	2803
10	2009	27.76	80.68	2908
11	2010	28.46	80.81	2840
12	2011	29.07	86.88	2989
13	2012	29.86	94.88	3178
14	2013	29.65	93.51	3154
15	2014	30.47	95.85	3146
16	2015	31.47	86.53	2750
17	2016	30.42	92.29	3034
18	2017	30.79	98.52	3200
19	2018	29.66	99.87	3369
20	2019	29.32	103.60	3534
CAGR %		0.97 ^{***}	2.24 ^{***}	1.26 ^{***}

Note: Mha = Million hectare, Mt = Million tone, ***-Significant at 10 % level.

Analysing trends in area, production and productivity of wheat in India it was found that the area under wheat cultivation has increased

from 27.49 million hectares to 29.32 million hectares during the year 2000 to 2019 (Table 5). Likewise production of wheat has increased from 76.37 Mt. to

Table 6: Trends in area, production and productivity of wheat in Afghanistan

Sl. No.	Year	Area (Mha)	Production (Mt)	Yield (kg/ha)
1	2000	2.03	1.47	724
2	2001	1.78	1.6	898
3	2002	1.75	2.69	1542
4	2003	2.32	3.48	1500
5	2004	1.89	2.39	1266
6	2005	2.35	4.27	1822
7	2006	2.45	3.37	1376
8	2007	2.47	4.49	1819
9	2008	2.14	2.63	1227
10	2009	2.58	5.07	1967
11	2010	2.36	4.54	1926
12	2011	2.24	3.39	1518
13	2012	2.52	5.05	2011
14	2013	2.56	5.17	2025
15	2014	2.66	5.38	2024
16	2015	2.13	4.68	2196
17	2016	2.31	4.56	1981
18	2017	2.11	4.29	2035
19	2018	1.64	3.62	2210
20	2019	2.34	4.89	2096
CAGR %		0.53^{NS}	4.69^{***}	4.16^{***}

Note: Mha = Million hectare, Mt = Million tone, ***-Significant at 10 % level, NS- Not Significant.

103.60 Mt. during 2000-2019. Similarly productivity has also witnessed increasing trend which increased from 2779 kg/ha to 3534 kg/ha during the same period. The compound annual growth rate of wheat area, production and productivity were found 0.97, 2.24 and 1.26 per cent per annum, respectively during the period of 2000-2019. The area has increased due to highly stable crop and sharp increase in minimum support price (MSP) and assured procurements by government. While increase in production and productivity was due to use of high yielding varieties (HYVs), balanced use of fertilizers and adoption of other improved technologies related to wheat cultivation. The previous study conducted to analyze the trends in the area, production and productivity by Nisha *et al.* (2019) and Ramdas *et al.* (2012) reported the similar result.

Trend in area, production and productivity of wheat in Afghanistan

The findings showed in table 6 and found that the area under wheat cultivation was 2.03 million ha in the year 2000, and it slightly increased to 2.34 million ha with a compound annual growth rate

of 0.53 per cent per annum during the period 2000 to 2019. Wheat production in Afghanistan was 1.47 million tonnes in the year 2000, which increased to 4.69 million tonnes in 2019. The trend analysis suggested that wheat production had achieved a significant compound growth rate of 4.69 per cent per annum during the same period. The average wheat productivity in the year 2000 was 724 kg ha⁻¹, and it increased to 2096 kg ha⁻¹ in 2019 and productivity achieved a growth rate of 4.16 per cent per annum during the same period. The total production and productivity of wheat increased due to adoption of improved technology of wheat cultivation and use of HYVs, balanced use of fertilizers and weedicides. Similar results were reported by Ahmadzai *et al.* (2019) in their study.

CONCLUSION

On the basis of the result obtained in the current study it can be done that use of improved technique of wheat cultivation can minimize the technology and extension gap to a significant amount thus leading to increase productivity of wheat in the various country. Compound annual growth rates of wheat area, production and productivity in

the world were 0.12, 1.63 and 1.52 per cent per annum, respectively. In India the compound annual growth rates of area, production and productivity were found to be 0.97, 2.24 and 1.26 per cent per annum, respectively. While compound growth rates of wheat area, production and productivity in Afghanistan were 0.53, 4.69 and 4.16 per cent per annum, respectively. The main reason of increase in production was due to increase in productivity as well as expansion in area under wheat cultivation. Whereas increase in productivity was due to use of high yielding varieties, balanced use of fertilizers and adoption of modern cultivation techniques. There is need to promote resource conservation technologies, awareness campaign among the farmers related to scientific package of practices, modern technologies, improved seed, integrated nutrients management *etc.* to reduce the gap between actual yield and potential yield of wheat in both the countries.

ACKNOWLEDGEMENTS

Authors wish to acknowledge CCS Haryana Agricultural University and who participated in the study and made the study successful.

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