Study on Agricultural Production in Nepal: a case Study in far Western Development Region

Govinda Bhandari
Environment Professionals’ Training and Research Institute Pvt. Ltd.
Kathmandu, Nepal. govinbhandari84@yahoo.com

Abstract—Agriculture is the largest sector and the backbone of the Nepalese economy and also it is the major source of livelihood of the majority of population in Nepal. In addition to modern technology, soil fertility, farm management practices, variety of seeds, prevalence of diseases and insects, and the weather are responsible for the variation of agricultural production. The total yield and average yield of five major cereals (viz. paddy, wheat, maize, millet and barley) in the years 1979, 1982, 1986, 1992 and 1994 has been reduced sharply. Dadeldhura of far western development region is the district where the total yield of cereals has significantly reduced and is below average in all the five different years.

Index Term—Agricultural, far western region, yield, Nepal

I. INTRODUCTION

Agriculture is the main source of livelihood for the majority of the people in Nepal. Over 88 percent of the population lives in rural areas, and about 80 percent of the rural population over 15 years of age is engaged in agriculture. Nearly two-thirds of rural household income is derived from agriculture related activities, and nearly 8 out of 10 people working in the agricultural sector are self-employed farmers. It is also the only activity where nearly 90 percent of the poor and very poor can earn some cash [4]. Many factors such as fertility of the soil, farm management practices, variety, prevalence of diseases and insects, and the weather are responsible for the variation of agricultural production [6].

Paddy (Oryza sativa L.) is the most important cereal, both in terms of cultivated area (taking on average 46 percent of total cereal cultivated area) and in terms of production. Paddy yield is quite variable from farm to farm and from country to country. CH-45, Parwanipur-1, IR24, Chandina, Laxmi, Bindeswari, Malika, Chaite-2, Chaite-4 and Chaite-6 are some of the varieties of paddy that are grown in Nepal. Blast, brown spot and bacterial blight are the major paddy diseases in Nepal that are caused by Pyricularia oryzae, Bipolaris oryzae and Xanthomonas oryzae pv. oryzae respectively. Use of proper Nitrogen, Phosphorous and Potassium (NPK) results better yield of paddy. Water management study in early rice conducted at National Rice Research Program (NRRP) during 1991/92 showed maximum grain yield of 6.23 t/ha from constant saturation condition (1cm depth) through out the growing period [8]. The increase in the paddy yield has been observed due to the availability of sufficient moisture during the paddy growing period from August to November [1].

Maize (Zea mays L.) is the second most important cereal in terms of total cereal cultivated area (24 percent). Rampur Yellow, Khumlal Yellow, Kakani Yellow, Hetauda Comp., Rampur Comp., Sarlahi Seto, Janaki, Arun-2, Manakamana-1, Rampur-2, Ganesh-2, Arun-1, Rampur-1, Makalu-2, and Ganesh-1 are some of the varieties of maize that are grown in Nepal. Balanced use, optimum doses and correct method, right time of application of fertilizers ensures increased crop production [7]. Maize is highly responsive to nitrogen fertilizer. However, the available soil analysis data indicated that the soil in Nepal is generally low to medium in total nitrogen content. Under such conditions supply of nitrogen fertilizer through external sources leads to increase in crop yield. Northern leaf blight, common rust, downy mildew, stalk rot complex are some of the major diseases that causes the loss in maize yield. Planting time plays key role in growth and development of crops. Planting dates of maize for different agro-ecological zone of Nepal has been recommended as: Mid and high hills (March-April) and Terai and inner Terai (April-May). Efficient interception of incoming solar radiation requires adequate and uniformly distributed leaf area so as to achieve complete ground cover. This can be obtained by manipulating plant density (plants per unit of ground area) and its distribution over the land surface. [5] reported that plant density of maize can be increased to 66,000 plants/ha without adverse effect. The yield of maize can be increased by providing sufficient moisture and manure, controlling disease and pests during initial, crop development and mid season [3].

Wheat (Triticum aestivum L.) is the third most important cereal in terms of total cereal cultivated area at 20 percent. NL30 and HD 1982, UP 262, Lumbini and Triveni, Vinayak, Siddhartha and Vaskar, Nepal 297, Nepal 251, BL 1022, Annapurna 1 are some of the varieties of wheat that are grown in Nepal. Wheat crop, in general, is less attacked by insects and pest in the field. Some sporadic incidences occur due to army worm (Mythimna separata), grass hopper (Heiroglyphus banian), wire worm (Agrotis spp.) and rodent’s infestation on wheat plants. But the major loss due to insects occurs in the seeds and grains under storage conditions. Modern wheat varieties are very much responsive to fertilizer application and require 100:50:50 kg/ha NPK under irrigated conditions whereas in rain-fed wheat the addition of 25 kg/ha K in the previously recommended dose of 60:40 kg/ha NP is beneficial [9]. The more amount of precipitation at the late season has reduced the yield of wheat in an agricultural land [2].

Millet (Eleusine coracana L.) is a relatively minor cereal in terms of area, occupying only 8 percent of total cereal cultivated land area.

Barley (Hordeum vulgare L.) occupies a very small area and is a cereals with particularly low yields of around one ton.
per ha. Because of its small area, the variability in production is quite high, as minor absolute changes of a few thousand hectares may result in big changes in crop production.

This study is conducted to explore the agriculture production and yield analysis of cereals of far western development region.

General description of the study area

The study was carried out in Far Western development region (FWDR) of Nepal which includes Seti and Mahakali zones. There are nine districts viz. Bajura, Bajhang, Darchula, Achham, Doti, Baitadi, Dadeldhura, Kailali and Kanchanpur as in the fig.1. The population of FWDR increased from 1320089 in 1981 to 1679301 in 1991 and to 2191330 in 2001. The traditional agricultural practice is prevalent in this region.

![Fig. 1. Map of Nepal and location of districts in far western development region, Nepal](image)

II. METHODOLOGY

1. Data collection

Time series agricultural data in Nepal is collected from the data books published by MoAC for 56 years period from 1950/51 to 2006/07. The total yield of five major cereals (viz. rice, wheat, maize, millet and barley) (TY) is calculated as in equation 1. The value of total yield is computed for 56 years, period from 1950 to 2006 which is used to sort out the agriculture drought years in Nepal as in equation 1.

\[
TY_n = \frac{(TP_{rice} + TP_{maize} + TP_{wheat} + TP_{millet} + TP_{barley})}{(TA_{rice} + TA_{maize} + TA_{wheat} + TA_{millet} + TA_{barley})} \times 1000
\]

(1)

Where,

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

To do this statistical analysis of yield, ‘EXCEL’ from the Microsoft software has been used.

2. Administrative based regional groupings

Eastern development region (EDR), Central development region (CDR), Western development region (WDR), Mid-Western development region (MWDR), and Far Western development region (FWDR) are also studied on the basis of TY and AAY to study the agriculture production in Nepal.

III. MAJOR AGRICULTURAL DROUGHTS IN NEPAL

National level total yield analysis of major cereals

The annual average total yield of major cereals for 56 years period from 1950/51 to 2006/07 is 1830 Kg ha\(^{-1}\). The total yield is below average except in the years 1960, 1964, 1965, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005 and 2006 which is 1834 Kg ha\(^{-1}\), 1889 Kg ha\(^{-1}\), 1858 Kg ha\(^{-1}\), 1892 Kg ha\(^{-1}\), 1923 Kg ha\(^{-1}\), 1838 Kg ha\(^{-1}\), 1925 Kg ha\(^{-1}\), 1927 Kg ha\(^{-1}\), 1967 Kg ha\(^{-1}\), 1961 Kg ha\(^{-1}\), 1987 Kg ha\(^{-1}\), 2103 Kg ha\(^{-1}\), 2164 Kg ha\(^{-1}\), 2199 Kg ha\(^{-1}\), 2206 Kg ha\(^{-1}\), 2316 Kg ha\(^{-1}\), 2317 Kg ha\(^{-1}\), 2279 Kg ha\(^{-1}\) and 2218 Kg ha\(^{-1}\) respectively. Therefore, the major agriculture drought years and the total yield of the respective years are tabulated below.
Maize: The average yield of maize from 1950 to 2006 is 1747 kg ha\(^{-1}\). The yield is below average in the years 1950, 1951, 1957, 1971, 1975 and 1977-1998. The yield has been reduced sharply and is below average in the years 1979, 1982, 1986, 1992 and 1994 which is 1332 kg ha\(^{-1}\), 1406 kg ha\(^{-1}\), 1386 kg ha\(^{-1}\), 1663 kg ha\(^{-1}\) and 1684 kg ha\(^{-1}\) respectively.

Wheat: The average yield of wheat from 1950 to 2006 is 1320 kg ha\(^{-1}\). The yield is below average in the years 1950-1981, 1984-1987 and 1992. The yield has been reduced sharply and is below average in the years 1979, 1986 and 1992 which is 1199 kg ha\(^{-1}\), 1309 kg ha\(^{-1}\) and 1245 kg ha\(^{-1}\) respectively. Similarly, the yield is above average in the year 1982 and 1994 which is 1357 kg ha\(^{-1}\) and 1507 kg ha\(^{-1}\).

Millet: The average yield of millet from 1950 to 2006 is 1071 kg ha\(^{-1}\). The yield is below average in the years 1950, 1951, 1955-1958, 1963, 1964, 1977 and 1979-1988. The yield has been reduced sharply and is below average in the years 1979, 1982 and 1986 which is 972 kg ha\(^{-1}\), 938 kg ha\(^{-1}\) and 913 kg ha\(^{-1}\) respectively. Similarly, the yield is above average in the year 1992 and 1994 which is 1168 kg ha\(^{-1}\) and 1110 kg ha\(^{-1}\).

Barley: The average yield of barley from 1950 to 2006 is 959 kg ha\(^{-1}\). The yield is below average in the years 1967-1994. The yield has been reduced sharply and is below average in the years 1979, 1982, 1986, 1992 and 1986 which is 895 kg ha\(^{-1}\), 869 kg ha\(^{-1}\), 864 kg ha\(^{-1}\), 931 kg ha\(^{-1}\) and 947 kg ha\(^{-1}\) respectively.

Administrative level total yield analysis

The total yield of cereals in MWDR and FWDR is below average in all the years viz. 1979, 1982, 1986, 1992 and 1994 respectively. The average yield of EDR, CDR, WDR, MWDR and FWDR is tabulated in the table below.
The yield in 1992 is below average in EDR, CDR and FWDR. The average yield of barley is 922 kg ha\(^{-1}\) in 1979. The yield in 1979 is below average in WDR, MWDR and FWDR. The average yield of barley is 869 kg ha\(^{-1}\) in 1982. The yield in 1982 is below average in EDR, MWDR and FWDR. The average yield of barley is 878 kg ha\(^{-1}\) in 1986. The yield in 1986 is below average in EDR, MWDR and FWDR. The average yield of barley is 922 kg ha\(^{-1}\) in 1992. The yield in 1992 is below average in EDR, CDR and FWDR. The average yield of barley is 935 kg ha\(^{-1}\) in 1994. The yield in 1994 is below average in CDR and FWDR.

**District level analysis of total yield of cereals**

The total yield of cereals of the districts of FWDR is tabulated as below. Dadeldhura district of FWDR is the district which has a reduced yield of cereals in all the years viz. 1979, 1982, 1986, 1992 and 1994.

### TABLE III

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bajura</td>
<td>1394</td>
<td>1278</td>
<td>1206</td>
<td>1105</td>
<td>1318</td>
</tr>
<tr>
<td>Bajhang</td>
<td>1277</td>
<td>1273</td>
<td>1134</td>
<td>1296</td>
<td>1406</td>
</tr>
<tr>
<td>Darchula</td>
<td>1203</td>
<td>1113</td>
<td>1088</td>
<td>1287</td>
<td>1349</td>
</tr>
<tr>
<td>Achham</td>
<td>1174</td>
<td>1160</td>
<td>1034</td>
<td>1453</td>
<td>1464</td>
</tr>
<tr>
<td>Doti</td>
<td>1396</td>
<td>1252</td>
<td>1180</td>
<td>1267</td>
<td>1419</td>
</tr>
<tr>
<td>Baitadi</td>
<td>1199</td>
<td>1236</td>
<td>973</td>
<td>1330</td>
<td>1419</td>
</tr>
<tr>
<td>Dadeldhura</td>
<td>1151</td>
<td>1096</td>
<td>1070</td>
<td>1276</td>
<td>1453</td>
</tr>
<tr>
<td>Kailali</td>
<td>958</td>
<td>1335</td>
<td>1603</td>
<td>1685</td>
<td>1836</td>
</tr>
<tr>
<td>Kanchanpur</td>
<td>842</td>
<td>1468</td>
<td>1570</td>
<td>1928</td>
<td>1866</td>
</tr>
<tr>
<td>Average yield</td>
<td>1177</td>
<td>1246</td>
<td>1206</td>
<td>1403</td>
<td>1503</td>
</tr>
</tbody>
</table>
## TABLE IV
Total yield (TY) of cereals in different years

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bajura</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bajhang</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Darchula</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Achham</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Doti</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Baitadi</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dadeldhura</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kailali</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Kanchanpur</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Where, “+” sign means the yield of cereals **above** average yield in different years
“-” sign means the yield of cereals **below** average yield in the respective years.

---

**Fig. 3.** Area (Hectare), production (Metric ton) and yield (Kg. per Hectare) of the major cereals of far western region’s districts in 1979
Fig. 4. Area (Hectare), production (Metric ton) and yield (Kg. per Hectare) of the major cereals of far western region’s districts in 1982
Fig. 5. Area (Hectare), production (Metric ton) and yield (Kg. per Hectare) of the major cereals of far western region’s districts in 1986.
Fig. 6. Area (Hectare), production (Metric ton) and yield (Kg. per Hectare) of the major cereals of far western region’s districts in 1992
Fig. 7. Area (Hectare), production (Metric ton) and yield (Kg. per Hectare) of the major cereals of far western region’s districts in 1994.
IV. RESULTS OF THE ANALYSIS

National level


The performance of paddy area, production, and yield has improved in the second half of the decade, reaching average growth rates of 0.7, 2.4, and 1.7 percent, respectively.

The performance of maize over the last 10 years has been unsatisfactory, both in terms of yield and area. With a production growth rate of only 1.9 percent over the 1990s, maize production has fallen behind population growth. Moreover, yields are extremely low, at only 1.7 tons per ha, suggesting that improved varieties and hybrids have not been widely adopted, and that the available seeds are predominantly low-yielding varieties. Moreover, there has not been any noticeable change in the growth rate over the course of the decade, suggesting not much has occurred in terms of technology dissemination.

The performance of wheat is the success case within cereals category. Production growth performance of 4.7 percent on average over the 1990s has been impressive and has outstripped population growth. Moreover, yield growth has been the major source of this growth, explaining almost 70 percent of total production growth. In spite of its good performance, yields of wheat are still low, on the order of only 1.6 tons/ha over the second half of the 1990s. This suggests that there is still a high potential for wheat technology improvements.

Even though production growth performance of millet was not bad over the 1990s (averaging 3.3 percent per annum), the pattern of growth has been rather disappointing for two important reasons. First, millet’s high production growth was mainly the result of area expansion. Second, yields actually declined over the period.

Administrative level

The total yield of cereals of WDR, MWDR and FWDR is below average except in the year 1982. In the year 1982, the total yield of cereals is below average in EDR, MWDR and FWDR.

At the regional level, the trend in yield variability is somewhat different. In the CDR, MWDR, and FWDR, where yields are on average 5.9 percent above, 7.7 percent below, and 4.6 percent below the national average. No significant changes in yield variability were found in the Eastern and Western regions. Yield variability in the Eastern and Western regions is largely unchanged, indicating that either no new technology has been introduced in these areas, or that the new technology being introduced is not having a significant effect on improving paddy yields over the past 10 years. In the Central, Midwestern, and Far-western regions, however, yield variability has declined, indicating that the introduction of new technology has led to a general improvement in paddy yields in the western part of the country.

At the regional level, new technology has not led to any noticeable change in yield variability, with the exception of the Eastern region where about 24.2 percent of Nepal’s maize is produced. In this region, yields over the 1990s were on average about 3 percent below the national average. Over the same period, maize yield variability declined by an impressive 30 percent per annum. Clearly, the introduction and adoption of new maize technology has been of benefit to this region.

In the Central region, where yields were 7.6 percent above the national average and in the Mid-western and the Far-western regions where yields were 9.0 and 13.0 percent below the national average, respectively, there has been a significant reduction in yield variability over the period.

District level

The yield of cereals in Achham, Dadeldhura, Kailali and Kanchanpur is below average in 1979. In 1982 the yield is below average in Darchula, Achham, Baitadi and Dadeldhura. In 1986 the yield is below average in Bajura, Bajhang, Darchula, Achham, Doti, Baitadi and Dadeldhura. In 1992 the yield is below average in Bajura, Bajhang, Darchula, Doti, Baitadi and Dadeldhur. Similarly, in 1994 the yield is below average in Bajura, Bajhang, Darchula, Achham, Doti, Baitadi and Dadeldhura as in table 3 and 4.

V. CONCLUSION

The total yield (TY) of five major cereals (viz. rice, wheat, maize, millet and barley) in the years 1979, 1982, 1986, 1992 and 1994 has been reduced sharply. Dadeldhura is the district where the total yield of cereals has reduced and is below average in all the five different years. This clearly shows that besides fertility of the soil, farm management practices, variety, prevalence of diseases and insects, weather, introduction and adoption of new modern technology is very important in far western development region to get good agricultural production.

ACKNOWLEDGEMENT

The author would like to thank to the Department of Hydrology and Meteorology (DHM), Ministry of Agriculture and Cooperatives (MoAC) and Central Bureau of Statistics (CBS) Nepal for helping with meteorological, agricultural and statistical data respectively to carry out this research. The author wishes to thank parents and family members for their encouragement and inspiration through out the whole study.

REFERENCES


