

WHEAT FLOUR INDUSTRY

1. INTRODUCTION

Although rice is the staple food for Myanmar people, wheat has been accepted as a supplementary diet or as a medical purpose for proper nutrition. Wheat was consumed by a limited number of people in earlier days, the increasing production could not meet the demand and thus, wheat grain and flour were imported annually to fill the gap between demand and supply.

Nowadays because of the wider acceptance of wheat eating habit, the demand of wheat in terms of flour required for rapid emerging factories producing noodle, various kind of breads, cookies and other delicacies is becoming higher reaching more than 70,000 mt in 1999-2000 but wheat is still not yet considered as a major crop in cereal crop. It is necessary to reduce the quantity of wheat flour imported from abroad by promoting wheat productivity through strengthening of research work and extensive services.

The local production could only provide for 20% of the total requirement assuming that per capita consumption is 6 kg of wheat flour. There are production constraints on wheat production in Myanmar such as weather constraints, agronomic constraints, management constraints, etc.

Some references indicated that wheat has been transported to Lower Myanmar mainly for the consumption of British and Indian people who lived there since those days. Some reports stated that wheat was first introduced in Sagaing Division from Indian with durum variety in 1880.

During the colonial period (1885-1941) wheat cultivation was gradually expanded in the plains of Shwebo, Sagaing, Monywa and Kyaukse districts and also in Shan Plateau mainly in Taunggyi district. Flour mills were also constructed during this period. According to the "Report of

the work of The Indian Factories Act” of 1881, 1911 and 1934, one wheat mill was established in 1899, two mills in 1911 and five mills in 1931. But wheat as grain and flour has been imported annually from abroad due to insufficient production so as to meet the local demand.

During the pre-war time wheat was not used by most of the indigenous people except the richer class of Myanmar who used to take wheat in the form of bread, biscuits, and cakes but the whole quantity of wheat and wheat flour locally produced and imported are practically consumed as a main diet by Indian and Europeans. Thus wheat production in this period was only meant for the sale to the non-indigenous people.

Before the World War II, the average sown area of wheat between 1900 and 1940 was about 13,000 hectares which gradually increase up to 65,000 hectares in 1962-63. Due to the effort of the successive governments to increase wheat production towards self-sufficiency and to reduce annual import of wheat, the area has been increased noticeably and reached to the area coverage of 70, 124 and 150 thousand hectares in 1970, 1980 and 1990 respectively. In the year 2000-01, the sown area under wheat was recognized as 79,000 hectares.

In pre-war days, the records showed that wheat grain and flour were mainly imported from India, Canada and Australia. The average yearly import from 1934-35 to 1938-39 was about 28,000 mt. After the World War II, the importation of wheat was found to be around 20,000 mt up to 1962.

2. REVIEW OF PAST PERFORMANCE OF WHEAT PRODUCTION AND ITS PRODUCTIVITY

2.1. Colonial Era (1901-02 to 1947-48)

The first known variety in Sagaing Division was durum variety introduced from India in 1880 and wheat cultivation was extended to Mandalay Division and Shan and Chin States. Wheat, another cereal of the country also showed variations both in the sown area as well as matured area. Yield in kg/ha also fluctuated greatly with the years as the crop was sown

under unstable weather conditions of dry zone in Mandalay and Sagaing Divisions and in Shan State. The variations of the matured area ranged from 6% to 50% indicating the uncertainties of the weather conditions of the areas where the crop was widely grown. Likewise the production varied with the years. In those days Myanmar people use wheat as a delicacy while the Indians and Europeans used as their staple food. As the Indians population increased through migration from India, the demand of wheat increased yearly and led to an import of wheat flour at an average annual rate of 4 to 5 thousand tons.

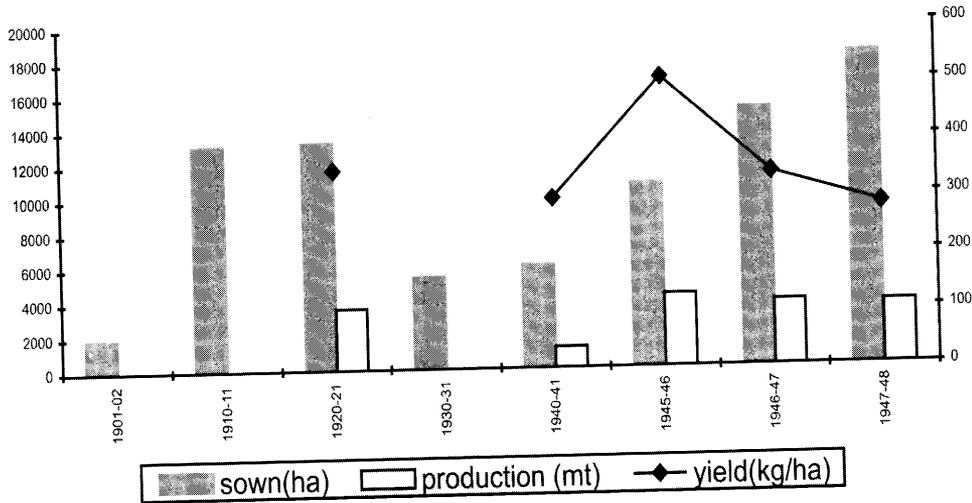
During this era, the average sown area for the whole country was estimated to be 13,000 hectares. Most of the varieties sown in the plains like Sagaing and Mandalay Divisions were hard wheat which were mainly used for bread and during those days hard wheat was very low in demand whereas soft wheat used as flour wheat grown in hilly regions has better demand. The average yield rate of wheat for the whole country in those period was 380 kg/ha. The total wheat production in those days was ranging from 400 mt to 9,000 mt (Chart 1).

Since the pre-war days wheat cultivation has been mainly carried out with the residual moisture after the monsoon season. Wheat sowing was generally done from October to mid-December in the plains but it started earlier in the beginning of October in hilly region. Irrigation for wheat cultivation was almost negligible in those days and about 100 hectares was found to be irrigated in Sagaing Division.

2.2. Independent Era (1948-49 to 1973-74)

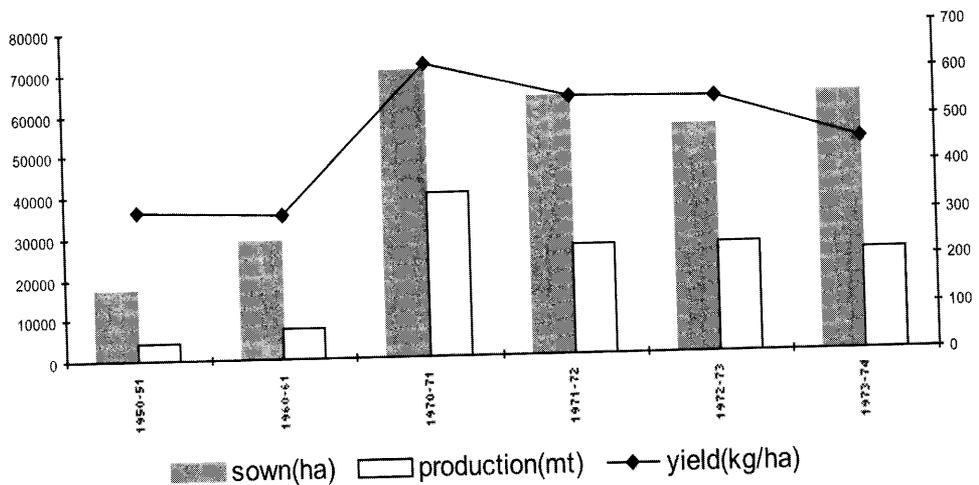
During this era, wheat cultivation was further extended to other States and Divisions, such as Kachin State, Kayah State and Magway Division. In 1948-49, which is the beginning of this era, total wheat sown area has been increased up to 17,000 hectares. The average yield rate was also observed having about 600 kg/ha in some years, higher than those in pre-colonial era. The area expansion during this era was happened mainly to be in Sagaing Division, Mandalay Division and Shan State where soils and climatic conditions are more favorable for wheat cultivation. Few areas in Bago Division, Ayeyarwady Division and Rakhine State are also

**Chart 1 : Wheat Sown Area, Yield and Production
(1901-02 to 1947-48)**



Source: MAS.

**Chart 2 : Wheat Sown Area, Yield and Production
(1948-49 to 1973-74)**



Source: MAS.

introduced wheat for adaptability tests. The highest peak on sown area was also found in 1965-66 reached the sown area of 166,000 hectares for the whole country. In the last year of this era of 1973-74, it was also recorded that the area under wheat for the whole country was stood at 63,000 hectares (Chart 2).

Due to concerted efforts made for agricultural development towards the increased production of crops by the government in those periods, wheat production has also been increased nearly three times from 3,000 mt in 1947-48 to 100,000 mt in 1965-66. But due to fall of wheat price in domestic market in 1966-67, area suddenly dropped to 95,000 hectares in 1967-68. The price of red wheat has fallen from 467 to 280 Kyats per ton and white wheat from 591 to 373 Kyats per ton. This downward trend of wheat area has continued for about seven years until 1973-74. The maximum record of wheat sown area in 1965-66 could not have been achieved until the last year of this era of 1973-74.

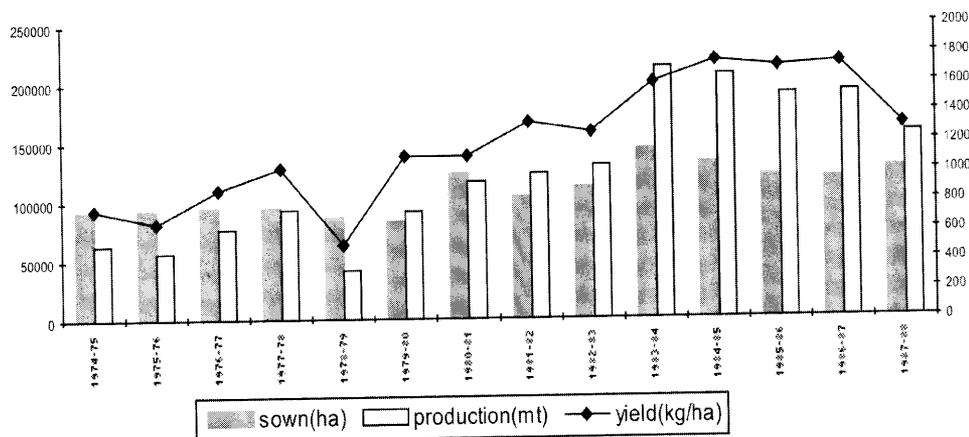
In this era, the average yield of wheat has found to be increased due to the use of chemical fertilizers, introduction of new improved varieties, and provision of improved technology and extension services. The average yield of wheat per hectare was 430 kg in those periods.

The planned agriculture has become more profound in this era. The commercial production has also been emerged due to the market price attraction to the growers. Chickpea is the most competitive crop to wheat as most of the soils cultivated with wheat are also good for used to change their crops according to the market price. Whenever chickpea price is higher, wheat area becomes lower.

2.3. Socialist Era (1974-75 to 1987-88)

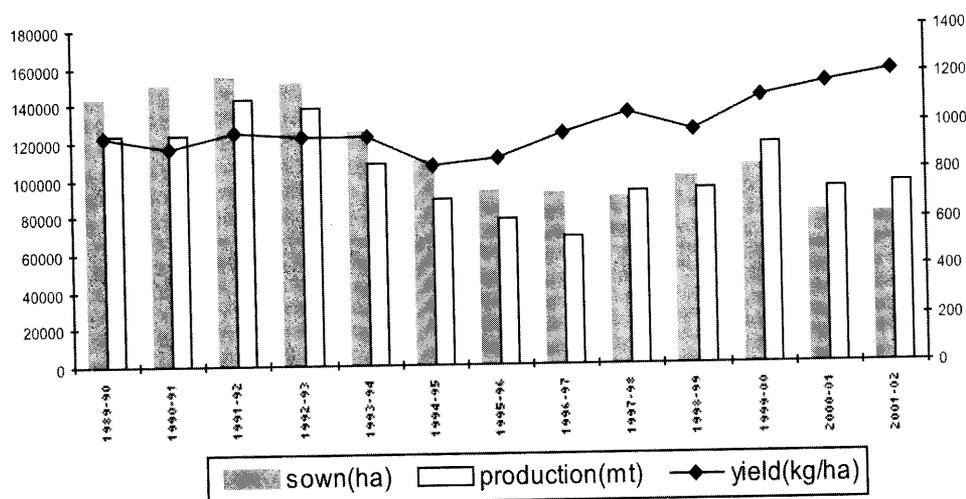
In the this era, wheat covered an area of 95,000 hectares. The area registered great fluctuation in last era but stabilized by about 95,000 hectares during the current era. The yield level improved steadily in this era starting with 745 kg/ha in the beginning of the era while rising to 1,743 kg/ha in 1984-85 with a slight set back in 1978-79, due to severe drought. The production stood at 63,000 mt in 1974-75, the beginning of the era,

**Chart 3 : Wheat Sown Area, Yield and Production
(1974-75 to 1987-88)**



Source: MAS.

**Chart 4 : Wheat Sown Area, Yield and Production
(1989-90 to 2001-2002)**



Source: MAS.

furnishing an increase of over 30% in a period of 10 years. This increase was due to the introduction of *The Whole Township Wheat Production Programme* initiated in 1979-80 along with the introduction of HYV, higher use of fertilizers and improved crop husbandry practices. Furthermore, by improving water management wherever possible together with variety changes, wheat production of the country has remarkably increased up to 210,000 mt in 1983-84. Wheat industry of the country was becoming large and the great potential for further improvement has been observed in this era. Wheat does not constitute the main diet, but from the health point of view has scope for expanding its share with the traditional rice in Myanmar food habits. Chart 3 shows wheat production situation in socialist era.

3. CURRENT SITUATION OF WHEAT PRODUCTION

3.1. Changing Situation

Wheat sown area in Myanmar has not been changed a lot since 1980-81 stagnating around 120,000 hectares before 1988-89. In the early period of this present day era, wheat area has been increased more than 150,000 hectares in 1991-92. From 1994-95, the sown area of wheat has been in down trend consecutively and at present (2001-02) the area stands at about 79,000 hectares. In general, area under wheat is terribly in downward situation for nearly a decade. This situation is being worsened mainly due to the low price of wheat grain being occupied by the larger sown areas by chickpea which provides better profit than wheat.

The unit yield of wheat at the present day era was not encouraging much having about 1 metric ton per hectare. The national average yield level was stagnant for almost more than a decade. It is also observed that per hectare yield of wheat in Myanmar is lower than the national average yield of 3.7, 2.6 and 2.2 mt/ha of China, India and Pakistan respectively. It clearly shows that intensive efforts on promotion of wheat yield is becoming less consideration not only on technical aspects but also on management as well.

When the present production of wheat is reviewed after 1989-90, it also

shows the decreasing trend of production because of declining areas under wheat. The present production could be recorded as around 100,000 mt.

The area, yield and production from 1989-90 to present could be observed in Chart 4.

In present day, the main wheat growing regions remain to be in Sagaing, Mandalay Divisions and Shan State owing to their suitable environmental conditions and area potentialities within the regions. Thus Sagaing, Mandalay Divisions and Shan State are still prominent as major wheat producing regions. However, few areas with lower yield rate can also be found in Magway, Ayeyarwady, Kachin, Kayah and Chin states and Divisions. Wheat production situation by States and Divisions in 2000-2001 is mentioned in Table 1.

Table 1 : Wheat Production Situation by States and Divisions (2000-2001)

State/Division	Sown area (ha)	Harvested area (ha)	Yield (kg/ha)	Production (mt)
Kachin	64	64	734	47
Kayah	57	57	649	37
Kayin	-	-	-	-
Chin	89	89	865	61
Sagaing	55,752	55,749	985	54,887
Taninthayi	-	-	-	-
Bago(East)	-	-	-	-
Bago(West)	-	-	-	-
Magway	543	543	1,180	641
Mandalay	11,520	11,520	1,483	17,084
Mon	-	-	-	-
Rakhine	-	-	-	-
Yangon	-	-	-	-
Shan(South)	6,439	6,439	1,569	10,105
Shan(North)	5,125	5,125	1,981	10,155
Shan(East)	-	-	-	-
Ayeyarwady	628	628	896	563
Total	80,217	80,214	1,167	93,580

Source: MAS.

3.2. Varietal History and Improvement

The first known wheat variety planted in Myanmar was durum variety introduced from India in 1880. This variety was severely attacked by leaf and stem rust and eating quality is also poor. Several varieties include Pusa 4, Pusa6, Pusa12, Pusa 52 and Pusa 111 were imported from India and Australia. Out of these varieties, Pusa 4 or Imperial Pusa 4 (IP4) later known up to now as Monywa white, IP6 and IP 12 were selected and grown commercially from 1929 to 1941. These varieties were fairly rust resistant. IP 4 is still growing at present as a local variety under the name of “Monywa White” which has been accepted as the most rust resistant variety all along the wheat growing history.

In 1952, new varieties were introduced from USA, Australia and India. Among them Lama 50, Yaqui 53 were selected and grown mostly in Shan State in 1956. In 1959, both varieties became susceptible to leaf rust and selection were again made out of the new varieties received from USA, Canada, Australia, India, China and Egypt. Among them only WC 4 variety which later known as “Shan White” from USA proved to be fairly resistant to rust and still widely grown in Shan state as a main commercial variety. Maxipak from Maxico, Kalayansona and Sharpathi Sonora from India were also introduced in 1968. These three varieties outyielded than any other varieties provided that irrigation and fertilizers are supplied adequately. However these varieties were not free from leaf or stem rust which had occurred in different localities in different years and reduced the yield to a certain extent.

In 1980-81, 16 tons of 5 new wheat varieties were again introduced from Pakistan and were extensively grown in Sagaing, Mandalay Divisions and Shan State after conducting experiments. These varieties were Lyallpura 73 (LYP 73), SA-75, Blue Silver, V-1287 and LU 26. These varieties yielded more than 1,636 kg/ha and if irrigated, V-1287 had a maximum yield record of 6,627 kg/ha. Many CIMMYT varieties (IBWSN series) and (W series) were also kept under the test program in 1983 together with 10 varieties such as Waringal, Kite, Axley, etc. from Australia and 2 varieties including (Yecora Rojo) from Japan.

The Central Agriculture Research Institute (CARI) has continuously tested and screened introduced varieties and could release Yezin wheat series as mentioned in the following table together with other varieties remained as major cultivars in Myanmar.

Table 2 : Name and Pedigree of the Wheat Varieties

Variety name	Year of release	Pedigree
Monywa white	1946	IP-4
Shan-White	1960	WC-4
Maxipak	1968	Maxipak
Kalayansona	1968	Kalayansona
Sharpathi sonora	1968	Sharpathi sonora
Yezin Wheat-1	1980	LYP-73
Yezin Wheat-2	1980	SA-75
Yezin Wheat-3	1980	V.1287
Yezin Wheat-4	1980	LU-26
Yezin Wheat-5	1980	Blue Silver
Yezin Wheat-6	1986	Veery.5
Yezin Wheat-7	1986	UP.262

Source: CARI.

Among the varieties released upto 1986, the most common varieties grown at present in Myanmar are Monywa white (IP-4), Yezin wheat-3 (V-1287), Maxipak and Shan white (WC-4). Area cultivated by major wheat varieties and its average yield in different region is shown in Table 3.

3.3. Cropping Practices in Major Wheat Growing Areas

Agro-ecological conditions in Upper Myanmar especially Sagaing and Mandalay Divisions are favourable for various kinds of crops. Cropping systems in both divisions are generally similar each having three cropping seasons. Premonsoon cropping generally takes place from February and followed by monsoon crops from May-June. After growing monsoon crop, winter cropping also practices starting from September-October. Most of the low lands are occupied with paddy and long staple cotton, and uplands by oilseed crops, cereals, peas and beans. The main cropping pattern for Sagaing and Mandalay division are mentioned in Table 4.

Table 3 : Area of Major Wheat Varieties and Yield in Myanmar

No.	State/ Division	Variety	Sown area (ha)	Yield (kg/ha)	Production (mt)
1	Sagaing	Monywa- white	55,752	985	54,887
		Yezin wheat-3 (V-1287)	47,119	979	46,153
2	Mandalay		8,084	1,080	8,734
			11,520	1,483	17,084
		Monywa- white	9,437	1,528	14,416
		Maxipak	139	1,230	171
		Yezin wheat-3 (V-1287)	834	1,657	1,382
		Chinese 98-15	135	3,252	439
		Others	975	693	676
3	Magway		543	1,180	641
4	Shan (south)	Monywa- white	543	1,180	641
			6,439	1,569	10,105
5	Shan (north)	Yezin wheat-2 (SA-75)	575	1,696	975
		Shan-white (WC-4)	1,929	1,531	2,953
		Yezin wheat-3 (V-1287)	1,422	1,712	2,434
		Maxipak	1,934	1,650	3,191
		Monywa-white	579	953	552
			5,125	1,981	10,155
		Monywa-white	3,821	1,871	7,148
6	Other regions	Maxipak	1,304	2,306	3,007
			865	818	708
Union Total			80,217	1,164	93,580

Source: MAS.

Table 4 : Cropping Pattern in Upper Myanmar

No.	Pre-monsoon	Monsoon	Winter
1	Long staple cotton	Paddy	-
2	Paddy	Sesame	-
3	Sesame	Paddy	-
4	-	Paddy	Wheat
5	-	Maize	Wheat
6	-	Sesame	Wheat
7	-	Groundnut	Wheat
8	-	-	Wheat
9	-	Paddy	Peas & Beans
10	-	Paddy	Long staple cotton
11	-	Paddy	Onions and Chillies

Source: MAS.

In Shan State, although planting of crops can be practiced almost the whole year round, two cropping seasons are distinct as monsoon and winter. Monsoon crop generally has been grown from April to September and winter crops from September to January. Most common cropping pattern can be seen in the following Table 5.

Table 5 : Cropping Pattern in Shan State

No.	Monsoon	Winter
1	Paddy	Wheat
2	Paddy	Peas and beans
3	Ground nets	Wheat or potato
4	Maize	Wheat or oilseed crops or potato
5	Soybean	Wheat or oilseed crops
6	Potato	Wheat

Source: MAS.

With the introduction of new short lived varieties for the preceding crops like paddy and sesame, double cropping systems are widely followed and cropping pattern has been greatly improved to grow wheat after monsoon crops. However wheat single cropping is still in practice to ensure sufficient moisture and correct time of sowing aiming to harvest good yield of wheat in Upper Myanmar. The average holding of a farmer in wheat growing is estimated to be about 2 hectares in which wheat and chickpea are usually grown almost in the same time. Therefore chickpea is a competitive crop to wheat in Sagaing and Mandalay Divisions, the largest wheat growing areas of the country. Wherever wheat area increases chickpea area decreases and vice versa, highly depending upon the price of crop. At present, this price factor of getting better income by chickpea pushes the wheat growers to diversify wheat with chickpea.

Irrigation practice in wheat cultivation is one of the impact points to increase per unit yield. Study on yield effect of irrigated and non-irrigated condition were made for several years. Production and yield of wheat under irrigation and non-irrigation in major wheat growing areas of Sagaing, Mandalay Divisions and Shan State are abstracted in Table 6.

According to the records, wheat has been grown by irrigation since 1940-41, having only 0.42% under irrigation. More than four decades, area under irrigation was less than 10% of the total wheat sown area. After 1979-80, it has been increased gradually around 15-20%. At present, irrigated area of wheat has been increased to more than 30%. Wheat sown area under irrigation for different periods could be observed in Table 7.

Table 6 : Production and Yield of Wheat under Irrigated and Non-irrigated Conditions in the Region (1979-80 to 1983-84)

Year	Irrigated				Non-irrigated		
	No. of Township	Sown area(ha)	Yield (kg/ha)	Production (mt)	Sown area(ha)	Yield (kg/ha)	Production (mt)
1979-80	26	13,018	2,911	36,208	69,614	786	54,286
1980-81	34	16,917	2,933	46,710	106,256	788	79,689
1981-82	36	12,523	2,940	34,612	90,688	1,108	89,081
1982-83	37	16,298	2,896	44,088	93,824	987	85,804
1983-84	40	21,611	2,883	59,344	120,119	1,369	154,645

Source: MAS.

Table 7 : Wheat Sown Area under Irrigation

Year	Total sown area (ha)	Irrigated area (ha)	% Under irrigation
1940-41	5,970	25	0.42
1950-51	17,295	50	0.30
1960-61	28,969	9	0.03
1970-71	69,716	1,345	2.00
1980-81	124,048	16,924	14.00
1990-91	149,717	17,402	12.00
1999-00	105,341	25,496	24.00
2000-01	80,217	25,496	32.00
2001-02	79,271	26,305	33.00

Source: MAS.

4. MAJOR CONSTRAINTS TO WHEAT PRODUCTION

4.1. Production Constraints

Wheat production in Myanmar has not been consistent due to variations in sown area, harvested area and per unit yield. Actually proper planning could have been started in 1974-75 to minimize uncertainties but the actual performance does not constantly correspond to the planned figures. Production constraints on wheat production are summarized as follow:

4.1.1. Weather Constraints

The influence of unfavourable weather conditions plays a vital role in wheat production, since wheat cultivation mainly depends upon the residual moisture. Usually monsoon starts in May and June and early monsoon crops like sesamum, groundnut, maize and paddy are normally sown with the first showers. But in some years, monsoon starts with less showers or starts with uneven distribution and under such condition planting of early monsoon crops are delayed with the consequences of late harvest. In such a condition, especially wheat after maize or paddy cannot be sown at the correct time and sometimes the land is left fallow due to lack of moisture. This is one of the reasons why wheat-sown area fails to meet the target. Late sowing also reduces the yield and is likely to suffer from rust attack. Old varieties such as Monywa white do not possess good genetic potential to survive in residual moisture stress. Even new varieties such as V-1287, LU26, LYP-73, SA-75 and Blue Silver tend to be having yield fluctuation under moisture stress. But with sufficient moisture in the soil or under irrigated condition, these varieties yield better than old varieties. That is why irrigation for wheat cultivation has to be highly encouraged on one hand for better yield, and short-lived drought resistant varieties will further be required to withstand the moisture stress problem in most wheat growing area on the other.

The intensity of late rain also highly influences the wheat-sown area and yield. About 5 inches (127 mm) average rainfall in October is not favourable for sowing when it is spreaded over for many days with few showers. The conditions become worst in the years having less than 5 inches

of rain in October or November and large area have to be left fallow with the results of down fall in wheat sown area. Because of high dependent upon soil residual moisture, drought resistant varieties are most needed and irrigation facilities are also highly encouraged in the wheat growing areas of under rainfed condition to overcome the uncertainties of weather for ensuring wheat sowing area and per unit yield.

4.1.2. Irrigation

Wheat sown area under irrigation at present is 33 % to the total wheat sown area of 79,000 hectares. Most of the irrigated areas lies in Sagaing and Mandalay Division having 30% and 3% respectively.

The experimental results also showed that irrigated wheat could yield up to 3,555 kg/ha. But some farmers' yield in the upper part of Myanmar in the irrigated zone was recorded as high as 6,454 kg/ha. It is obviously showed that irrigation can give higher yield and if properly irrigated with sufficient input facilities, the average yield of 4,840 kg/ha could easily be obtained. For such a potential in yield level, irrigation for wheat is being encouraged by developing various water resources.

4.1.3. Varietal Constraints

Monywa white variety is largely grown in Sagaing and Mandalay Divisions. Because of its fairly resistance to rust, higher price in the domestic market, and also because of its wider adaptability and suitability for making several kind of wheat products, Monywa white variety has been accepted by the farmers since many years ago. At present 85% in Sagaing Division and 89% in Mandalay Division are grown with Monywa white variety. The sown area under Maxipak also declining in Sagaing and Mandalay Divisions Kalayarsona and Sharpathi sonora varieties are almost mixed up and nearly out of cultivation.

Five new varieties LU-26, LYP-73, V-1287, SA-75 and Blue Silver were again introduced for their higher yielding and better qualities. Among them, V-1287 for irrigated tract and wider adaptability, LU-26 for wider adaptability and Blue Silver for late sowing are so far accepted for

replacing Monywa white and Maxipak varieties. Furthermore, new wheat varieties suitable for low land and upland and disease resistant varieties are also being tested to substitute with present genetically eroded varieties in terms of quality, yield and disease resistance.

4.2. Agronomic Constraints

4.2.1. Low Fertility

In some of the marginal soils in Sagaing and Mandalay Divisions, fertility level is very low especially in nitrogen content and pH level is very high. It is not suggestible to grow wheat or any other crops in those marginal soils. To eliminate this area limitation, more practical works need to be done for the improvement of soil fertility.

4.2.2. Limited Use of Fertilizers

Before 1988, almost all of the chemical fertilizers were solely handled by the government and distributed to the farmers through government channel. One of the major constraints in those days was the insufficient supply of chemical fertilizers. The supply never met the demand although the requirement was not very high. After 1988, due to the open market economic policy, the private entrepreneurs have been encouraged to enjoy in the business on importation, distribution and selling of chemical fertilizers to the growers. But because of high price of chemical fertilizers in domestic market, it is also found that most farmers could not apply chemical fertilizers according to the recommended rate. Inorganic fertilizers such as farmyard manure are also used by most farmers but these are not available enough. Use of compost is widely demonstrated all over the country by the extension division to incorporate with the use of chemical fertilizers.

4.2.3. Competitive Crop

In Sagaing and Mandalay Divisions where the largest area of wheat occupied, chickpea is a competitive crop to wheat. When the chickpea price is higher, wheat areas become less and vice-versa. This phenomenon has

already been kept under control by proper planning by the government before 1988. After the relaxation of the government policy on controlling crops cultivation, farmers have their own choice to grow more profitable crop either wheat or chickpea.

4.3. Management Constraints

4.3.1. Land Preparation

There are still some farmers who do not care about proper tillage, lacking in proper depth uniformity, leaving the furrow slices improperly crushed, and lacking in proper leveling which lead the consequences of poor seed germination and weak growth. Extension activities are being intensified with various means to correct such deviations especially in the time when the *Whole Township Wheat Production Programme* was under implementation. Many farmers came to realize the advantage of proper tillage.

4.3.2. Seeding

Line sowing practice in wheat had been introduced around 1950, sowing method by broadcasting has almost disappeared in Sagaing and Mandalay Divisions. But in Shan State, broadcasting method is still in practice in many places. Farmers are now being convinced about the benefit of proper plant population for the easiness of weeding, proper light effect and insects and diseases control by using line sowing method. Locally made seed drills are now commonly used in Sagaing and Mandalay Divisions. However, some of them are weak in controlling proper seed rate. Continuous efforts are being made both by the growers and researchers to improve them to fit in the local conditions.

4.3.3. Planting Time

Delay in planting time is very common in Sagaing and Mandalay Divisions. There are two main reasons, one is because of the dry spell before the time of sowing and thus farmers have to wait for enough rain to catch the moisture. The other is due to the late harvest of first monsoon crop

especially maize and paddy when these crops are sown late due to abnormal early rains. The other reason for delayed planting time is some farmers do not care much about on correct time of sowing due to the various reason for which extension activities are being reinforced. Suitable time of sowing is also determined from the research works and recommended the farmers to sow seeds between middle of October to middle of November in the plains and for Shan State recommended to sow during the month of October. Drought resistant varieties are also being looked for to withstand moisture stress.

4.3.4. Weed Control and Diseases

Weeding is the essential work for better crop production. Weeding is indeed a laborious work and costly and it also needs to be repeated for several times. Because of labour extensive and high investment for cost of weeding, most wheat growers normally practice less weeding and in consequence yields are lower than they expect. Nowadays, some affordable farmers use herbicides in the crop production ever though the prices of herbicides are higher.

Leaf and stem rust are the major enemies of wheat cultivation in Myanmar. In 1967, leaf rust epidemic caused up to 60 % damaged to the total wheat sown area. However in dry and less humid conditions, severity of the disease normally becomes low. Research programmes should be strengthened to incorporate resistance in local and high yielding varieties.

4.4. Institutional Constraints

CARI is being carried out research programmes especially on varietal improvement and agronomic practices. But CARI could also produce Yezin 1 to Yezin 5 series of improved wheat varieties in 1980 and Yezin 6 and Yezin 7 in 1986 only. These varieties are short to medium aged varieties having good potential for high yielding. CARI also established four outreach research stations in Upper Myanmar and in Shan State. The major research activities are being managed and conducted at CARI. Seed Division is also taken part in seed multiplication and production programme of wheat developed by CARI.

Both CARI and Seed Division are lacking in research facilities for wheat milling and quality analysis. ADB financed “Second Crop Intensification Programme” have served the purpose to alleviate this constraints to some extent, as it supplied some test flour mills and baking ovens.

At present, wheat is not considered as a major crop in cereal crop group, both research and extension services are found to be weak. But it may also need to consider the spending of foreign exchange currency for the importation of wheat flour every year to supplement the demand. It should be necessary to reduce the quantity of wheat flour imported from abroad by promoting wheat productivity through strengthening of research works and extension services.

5. CONSUMPTION PATTERN OF WHEAT, WHEAT IMPORT AND STATUS OF SELF-SUFFICIENCY

5.1. Consumption Pattern

Before the World War II, wheat eating habit was not very common to Myanmar and only Indians, Europeans, and some higher class and middle class population accepted foods made of wheat.

After World War II, wheat consumption was getting popular among the people across the country and widely accepted as their common food supplement but not taking as regular meals. These were sometimes taken as a breakfast and mostly as a snack. Due to wider acceptance of wheat for eating habit both in rural and urban, at present, wheat demand is showing an increasing trend. The wheat flour importations are sharply increased in late 1990’s because of the rapid emergence of hotels and restaurants, foodstuff industries, modernized snack shops and among others particularly in cities and towns.

The amount of wheat consumed in Myanmar varies according to the amount of production and import. Since the total amount of yearly production (exclusive of seed purpose and 4% post harvest loss) plus total yearly imported wheat has been consumed by the nation, per capita consumption rate may change every year. However, per capita consumption

has grown up from 1.52 kg in 1970-71 to 2.99 kg in 2000-01.

5.2. Wheat and Wheat Products Utilized in Myanmar

5.2.1. Wheat Grain

Wheat grains boiled with water and added some sugar or jaggery and used to eat as breakfast or lunchtime supplement. This eating habit is mostly found in the upper part of Myanmar. It is also used in alcohol manufacturing.

5.2.2. Fine Flour

Fine flour is mostly used for making quality breads, cakes, various form of biscuits, crackers, noodles (dry and soft form), pastries and different form of flat breads such as htat-ta-ya, paratha, puri, non-pya etc. At present, instant noodle packets are becoming popular for its easy way to prepare as a meal. Cakes, breads, htat-ta-ya, non-pya, and puri are also common in most cities and town. Apart from these major uses, fine flour is also used in preparation of soup, fries and curries. Many people also used fine flour for making glue.

5.2.3. Coarse Flour

Coarse flour is used for the preparation of chapatti (flat bread) over fire for consumption mostly consumed by Indians.

5.2.4. Semolina

Semolina is the collection of fine pieces of wheat used for making "Sanwin-ma-kin" some wheat like soft cake generally baked with coconut milk, sugar, egg and edible oil or butter. It is highly appreciated and consume by Myanmar people, generally served as parties, ceremonies and religious offerings.

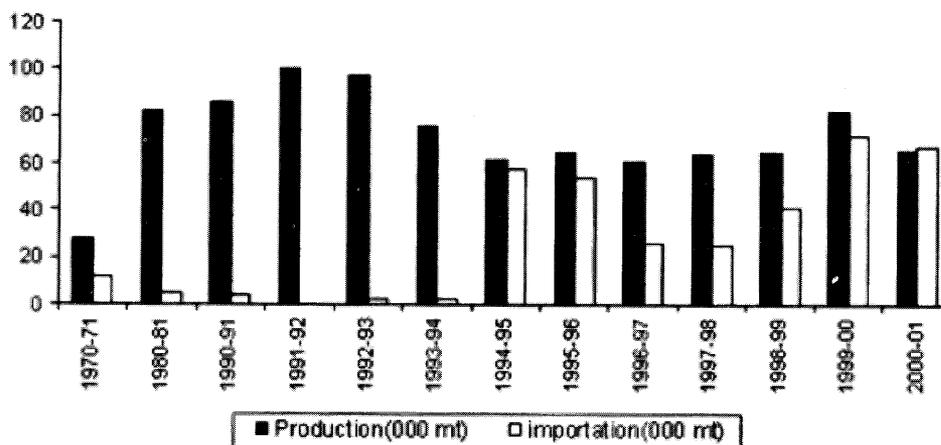
5.2.5. Wheat Bran and Straw

Wheat bran is mainly used as animal feed. Wheat straw is used as an animal fodder in dry season. Some artists make various handicrafts using bright coloured straw.

5.3. Wheat Import and Status of Self-Sufficiency

Since pre-wartime, the production did not meet the actual demand for local consumption and thus wheat in the form of flour and unmilled wheat (grain) were imported yearly. During the pre-war period from 1936 to 1941 the average annual import of wheat and wheat products was 33,207 tons and decline to 27,040 tons during the post war period of 1953 to 1962. The amount of wheat flour and grain imported were varied year by year since 1970. In some years, the imported quantities for wheat flour were more than 25,000 tons but in some years no importation of wheat flour was observed. The same is true to importation of unmilled wheat since 1970. No evidence was recognized for the fluctuation of the import quantity of wheat and wheat products. The regular importing countries are Australia and Canada. But other countries like China, India, Japan, France, United Kingdom and USA have also participated at times for a small amount. Yearly import of wheat flour and unmilled wheat are mentioned in Table 8.

Chart 5 : Wheat Production and Importation



Source: Report to Pyi-thu-hlut-taw and Statistical Year Book.

Table 8 : Yearly Import of Wheat in Myanmar

(thousand mt)

Year	Wheat grain		Wheat flour	Total wheat
	Grain	Equivalent to flour		
1956-57	4	3	20	23
1957-58	-	-	21	21
1958-59	4	3	23	26
1959-60	17	11	20	31
1960-61	4	3	20	23
1961-62	12	8	20	28
1962-63	10	7	24	31
1963-64	25	16	11	27
1964-65	-	-	3	3
1965-66	5	3	-	3
1966-67	53	34	-	34
1967-68	22	14	-	14
1968-69	6	4	-	4
1969-70	10	7	-	7
1970-71	19	12	-	12
1971-72	4	3	-	3
1972-73	1	1	-	1
1973-74	-	-	-	-
1974-75	18	12	-	12
1975-76	10	7	-	7
1976-77	3	2	-	2
1977-78	3	2	-	2
1978-79	5	3	-	3
1979-80	5	3	-	3
1980-81	7	5	-	5
1981-82	22	14	-	14
1982-83	-	-	-	-
1983-84	47	31	-	31
1984-85	-	-	-	-
1985-86	-	-	-	-
1986-87	-	-	-	-
1987-88	-	-	*	*
1988-89	-	-	*	*
1989-90	*	-	-	*
1990-91	-	-	4	4
1991-92	-	-	-	-
1992-93	-	-	2	2
1993-94	-	-	2	2
1994-95	-	-	58	58
1995-96	-	-	54	54
1996-97	-	-	26	26
1997-98	-	-	25	25
1998-99	-	-	41	41
1999-00	-	-	72	72
2000-01	-	-	67	67

Source: Report to Pyithu - Hlut Taw and Statistical Year Book. * Less than 1,000

The amount of wheat consumed is the total amount of wheat produced within the country plus the amount of wheat flour and unmilled wheat imported into the country. Yearly per capita consumption from the year 1970-71 can be seen in the following Table 9.

Table 9 : Per Capita Consumption of Wheat

Years	Production (000 mt)	Imported wheat flour (000 mt)	Total (000 mt)	seed rate and wastage (000 mt)	Local consump- tion (000 mt)	Popula- tion (000 mt)	Per capita consump- tion (kg/head)
1970-71	28	12	40	7	33	27,637	1
1971-72	19	3	22	6	16	28,262	1
1972-73	19	1	20	6	14	28,886	0
1973-74	18	-	18	6	12	29,521	0
1974-75	45	12	57	9	48	29,778	2
1975-76	40	7	47	9	38	30,389	1
1976-77	53	2	55	10	45	31,009	1
1977-78	66	2	68	10	58	31,642	2
1978-79	29	8	32	8	24	32,284	1
1979-80	64	8	67	9	58	32,939	2
1980-81	82	5	87	13	7	33,608	2
1981-82	87	14	101	11	90	34,287	3
1982-83	91	-	91	12	79	34,976	2
1983-84	149	31	180	17	163	35,663	5
1984-85	144	-	144	15	129	86,361	4
1985-86	133	-	133	14	119	37,073	3
1986-87	134	-	134	14	120	37,800	3
1987-88	110	*	110	14	96	38,540	2
1988-89	91	*	91	14	77	39,290	2
1989-90	87	*	87	15	72	40,034	2
1990-91	86	4	90	15	75	40,786	2
1991-92	100	-	100	16	84	41,552	2
1992-93	97	2	99	15	84	42,333	2
1993-94	76	2	78	13	65	43,116	2
1994-95	62	58	120	11	109	43,922	2
1995-96	65	54	119	10	109	44,744	2
1996-97	61	26	87	10	77	45,565	2
1997-98	64	25	69	9	60	46,402	1
1998-99	65	41	106	11	95	47,200	2
1999-00	82	72	154	11	143	49,133	3
2000-01	66	67	133	9	124	50,125	2

Source: Report to Pyi-thu-hlut-taw and Statistical Year Book.

* Less than one thousand

According to Table 9 the lowest per capita consumption rate of 0.41 kg could be found in 1973-74 and the highest rate of 4.57 kg in 1983-84. The present per capita consumption rate of about 2.5 kg cannot be assumed to be sufficient because of the higher prevailing price of wheat flour, and insufficient supply to meet the present demand.

If per capita consumption is to be assumed roughly as 6 kg/head/annum to fully meet the present day demand, the total amount required for sufficient home consumption will be 300,000 tons against the total production of 66,000 tons in 2001-02. Therefore self sufficiency ration will be 20% with the deficit of 234,000 tons of wheat flour.

6. MARKETING OF WHEAT AND WHEAT FLOUR INDUSTRIES

6.1. Marketing System

Although wheat is not a staple food of Myanmar people, the production does not meet the demand and accordingly it has been imported yearly since the pre-war period. The importation of wheat grain and flour varies year by year depending on the local demand. It is hard to make analysis on annual requirement of wheat to be imported. Data on import figures are not significant to draw concrete annual requirement for domestic consumption.

Before the opening of market economic system, wheat demands are made generally by State-owned mills and private enterprises. Foodstuffs and General Merchandise Trade Corporation (FGMC), later renamed as Foodstuff Industries, buys wheat grains from farmer to run its flour-mills. Purchase of wheat grain is done by FGMC but in some places it is done through cooperatives. Wheat is non-controlled crop item and can be purchased by private traders or flour-mill owners. The private market price varies according to the local supply. Generally it varies from about 70 to 100 Kyats. FGMC after milling in its mills, distributes wheat flour to various state owned foodstuff industries. Some of them are also distributed to private foodstuff industries and cooperatives. Imported wheat flour is also distributed to state owned wheat industries, consumer's cooperatives and private industries. The wholesale FGMC price for a 88

1 lb bag of wheat flour is 141.10 Kyats (3.53 Kyats/kg) and private market price varies from about 4 to 7 Kyats per kg depending upon the stock position.

At present, due to the market oriented economic policy, trading on wheat grain produced in the country is freely allowed and thus both government agency and private entrepreneurs are enjoying at the competitive markets in major wheat growing areas. Foodstuff Industries of Ministry of Industry (1) has procured wheat grain directly from farmers by opening buying depots at the major wheat growing areas with the prevailing market price to meet the demand of their state-owned wheat flour-mills. The wheat flour-mills under Ministry of Industry (1) are running their mills using the wheat grain procured only from the local markets. Ministry of Industry (1) does not import wheat flour or grain from abroad. Private sector has been encouraged by the government to partially fulfil the domestic requirement and thus private sector is being allowed to import wheat grain as well as wheat flour and also mill and to trade freely for the imported wheat.

Two major wholesale markets for wheat are at Yangon and Mandalay. Wheat flour from Yangon markets generally flows to the Mandalay markets and thus Mandalay markets is considered to be a main distributor of wheat flour to Upper Myanmar. Wheat grains are also traded in Mandalay markets and four types of wheat grain namely Myinmu wheat, Monywa wheat, Myaung wheat and Shan wheat are procured, milled and distributed to other parts of the country.

6.2. Cost of Production and Farm-gate Price

The average farm-gate price of wheat grain at harvest season has been increased year after year as production cost is becoming higher. The cost of production for one basket (32.65 kg) of wheat grain is compared with the farm-gate price for different years in Table 10.

The cost of production for a basket (32.65 kg) of wheat at 1990-91 was recorded as 134.43 Kyats and it increased to 884.48 Kyats in 1999-2000 with a growth rate of 85% within a decade. The same trend is true

Table 10 : Comparison of Cost of Production and Farm-gate Price of Wheat Grain

Year	Cost of production per basket (32.65 kg)	Farmgate price per basket (32.65 kg)
1978-79	47.06	69.00
1989-90	70.55	317.34
1990-91	134.43	390.80
1991-92	n.a	429.11
1992-93	288.80	432.05
1993-94	n.a	665.71
1994-95	385.54	710.11
1995-96	n.a	850.11
1996-97	n.a	1,418.75
1997-98	799.88	1,483.00
1998-99	n.a	1,658.00
1999-00	884.48	3,127.00
2000-01	n.a	3,500.00
2001-02 (Prov.Ac)	n.a	6,500.00

Source: Official files of Myanmar Agriculture Service.

to the farmgate price of wheat grain received by farmers was 390.80 Kyats in 1990-91 and it increased yearly and reached 3127 Kyats by basket in 1999-2000 at the grown rate of 88%.

6.3. Wheat Flour Industries

Myanmar is still wheat importing country. The local production could only serve for 20% of the total requirement assuming that per capita consumption is 6 kg of wheat flour. In 2000-2001 the private sector imported 67,000 mt of wheat flour. It is far below the actual requirement of about 200,000 mt. The import data on wheat flour witnessed the increasing trend in last 2-3 years.

It is also learnt that wheat import at present is solely done by private sector. There are two wheat flour mills in Yangon operated by private owners producing with 25 different brands. In Mandalay, where whole-sale market for wheat grains is existed, it is recorded that altogether 127 wheat flour mills are now fully operated by private sector and distributing with 16 brands of wheat flour.

Most of the foodstuff industries pay their attention to produce noodles and assorted biscuits. There are two biscuit factories, two noodle mills and two wheat flour mills operated by Ministry of Industry (1). The government owned wheat industries and its capacity and production are abstracted in Table 11.

Table 11 : Government Owned Foodstuff Industries

No.	Particular	Capacity (mt/annum)	Actual production (mt/annum)
1	Hlaing noodle mill (Yangon)		
	1999-00	1,474	152
	2000-01	1,474	186
	2001-02	1,474	193
2	Magyisin noodle mill (Sagaing)		
	1999-00	74	47
	2000-01	74	33
	2001-02	74	13
3	Okkala biscuit factory (Yangon)		
	1999-00	522	504
	2000-01	522	634
	2001-02	522	800
4	Padethar biscuit factory (Yangon)		
	1999-00	274	165
	2000-01	274	237
	2001-02	274	235
5	Wheat flour mills (Roller)		
	1999-00	4,800	411
6	Dagon wheat flour mills (Yangon)		
	1999-00	4,800	2,133
	2000-01	4,800	1,507
	2001-02	4,800	1,472

Source. Foodstuff Industries, Ministry of Industry (1).

There are many registered private enterprises for making various foods made of wheat. Wheat food industries are emerging with faster rate in Yangon, Sagaing and Mandalay Divisions. There are also various kinds of bakeries, confectioneries, restaurants and hotels by government and private in many cities and towns consuming increasing amount of wheat flour. As the population increases, the number of bakeries and confectioneries will also be increased yearly. Demand of wheat flour may always be higher than supply in future.

7. RESEARCH AND HUMAN RESOURCES DEVELOPMENT

7.1. Research Development

There are research institutions carrying out research activities under Myanma Agriculture service, namely Central Agriculture Research Institute (CARI) and Seed Division. Most of the basic research works are done at CARI and its satellite research stations. Seed Division is mainly concentrating on applied works and multiplication of improved seeds in its central farms and seed farms located in different states and divisions.

In fact, wheat research has been started in Myanmar since 1946, with a breeding program by introducing IP-4 variety from India. Because of the occurrence of most disease for years in wheat growing, breeding was strengthened in 1952 at Taunggyi and Banyin farms in Shan State, focusing on producing rust resistant wheat lines. For this purpose, intensive selection program with about 1,300 exotic varieties followed by a crossing program has been carried out up to 1966 and enabling to produce fairly rust resistant varieties.

Wheat research could be concentrated systematically after Agriculture Research Institute has been moved to Yezin. Most research activities have been started again in 1974. Since those time, several wheat varieties were received from International Maize and Wheat Improvement Centre (CIMMYT), Pakistan, USA, Germany and Philippines. Apart from breeding program, experiments on varietal testing, seed rate, time of sowing and methods, spacing and fertilizer rates have been conducted in full swing. But the research program on wheat was becoming weak and

lessened at around 1987 because most research works were in favor for rice, maize and other important crops. Nowadays, only varietal testing is conducting in the wheat major research farms.

A considerable works on wheat have so far been done, yet there are still many more to be continued with correct concept and dynamic efforts so that wheat research may be able to effectively support the development of wheat production with its own results to suit with different agro-ecological zones and socio-economic conditions.

According to the present situation, wheat research in Myanmar is becoming weak. If the government policy is to enhance wheat production in future, research will be the backbone for proper development. If it is so, the strategy will be focused on area expansion and yield increase. For both strategies suitable technology will be necessary. Therefore, precise and applicable research works may be required to carry out including breeding programs, various agronomic studies, milling and quality testing. At the same time sufficient number of trained staff and upgrading of research facilities should also be considered and undertaken.

7.2. Human Resources Development

Wheat research activities were properly conducted in 1978 undertaken by Cereal Division of CARI. The research activities carried out by CARI were highly admirable and could adopt suitable technology and varieties up to 1987. Later that period, research activities are mainly focused on other major crops to be inline with the immediate needs of the country and fewer assistance from international wheat research institutions like CIMMYT, wheat researches are becoming weak and thus varietal testing programme and some experiments on agro-techniques are presently carried out by four satellite farms of CARI. Only eight technicians are now engaged in wheat improvement in Myanmar.

In the area on development of wheat production in Myanmar, there is no postgraduate degree holder for breeding and agronomy. Altogether ten technical staff were trained in CIMMYT for wheat improvement, wheat technology and breeding from 1987 to 2002.

8. PROSPECTS AND CHALLENGES

8.1. Research Aspects

Research activities on wheat are directed towards the increased productivity, which may involve area expansion and yield increase. Research study also shows that wheat area could be expanded down to lower part of Myanmar where large potentials as double cropping after rice. But high temperature in growing period tends to reduce the yield due to low tillering, thus research direction should be prioritized to enable to release heat tolerant varieties.

At present about 70% of the total wheat sown area are grown with residual moisture. Due to uncertain rain in October, it has often been a problem to conserve enough moisture in the soil and to receive this moisture stress condition, drought resistant varieties can only be expected as a breakthrough for which breeding and selection programs be directed to produce short-lived varieties.

Improvement of proper agro-techniques including sowing time, water management practices, cropping pattern should also be carried out with a view to suit with the different ecological conditions. Rust diseases are the major enemies in wheat cultivation and thus breeding program must be directed to produce rust resistant varieties. Moreover, quality improvement for higher protein contents, milling quality, palatability, colour, and taste are also required to be put into the breeding program.

8.2. Land Potential

Present wheat varieties have wide adaptability to different types of soil. Wheat can be grown well in different soil like red earth, yellow earth, Shan state meadow, red brown savanna, cinnamon, compact, meadow dry zone and meadow wet zone in Myanmar. Area expansion should be focused on those soil types wherever possible in different states and divisions. However, there are greater potential in short-lived paddy growing areas where double cropping of wheat may be possible after paddy. Cultivable wasteland, fallows and short-lived paddy growing areas will

be potential area for expansion of wheat area.

8.3. Human Resources Development

As research is the backbone for wheat improvement, the human resource development will be required for strengthening of wheat researches. The technical staff currently involved in the wheat research activities is negligible quantity to conduct several types of researches for wheat improvement. If wheat crop has been considered as one of the major crop for local consumption, it may definitely need to strengthen research works and in this connection, human resources development will become as a major issue for the development of wheat industry.

9. RECOMMENDATIONS FOR IMPROVEMENT OF WHEAT INDUSTRIES

The following recommendations are addressed for the improvement of wheat in Myanmar.

- a. Promotion of wheat production can be done through area expansion on cultivable wasteland, fallow land and increase double cropping area after paddy. Lower part of Myanmar is suitable potential areas for expansion of wheat.
- b. Crop intensification program on wheat should be implemented where whole township wheat production program was introduced and in other potential townships, with the provision of quality seed, proper agro-techniques and agricultural inputs aiming to increase per unit yield.
- c. Wheat cultivation under irrigation should also be expanded to assure the crop success and higher yield.
- d. Strengthening of research activities will be required with short and long-term perspective.
- e. Human resource development will also be needed to reinforce the current research activities.
- f. It will also be required to strengthen the relation with international wheat research institutions.
- g. Bilateral assistance should be seek especially for strengthening of research, upgrading of technical capability of staff and human resource development.

10. CONCLUSION

At present, wheat products are taking place as a major food items. In sufficient production quantity of wheat in the country, huge amount of wheat flour and grain will still be required as a partial supplement for the domestic use due to the increasing demand of wheat flour for the industries of bakeries, confectionaries, noodle and several types of products.

The only way to reduce the importation of wheat is to make emphasis on area expansion where feasible to recover the level of 150,000 to 160,000 hectares and try to achieve increased productivity through promotion of per unit yield up to 1.5-2.0 tons per hectare.

Present marketing system is found to be in proper practice because of the open market oriented economic system. Private sector is completely taken place in the whole marketing system both for local and foreign markets.

The government should only pave the way to produce suitable new varieties for different agro-ecological conditions, multiplication and distribution of quality seeds and to develop appropriate technologies by strengthening of existing wheat research activities.

Present wheat flour mills and different types of factories owned by government and private sector are found to be quite sufficient in number to meet the domestic demand.

REFERENCES

1. Chit Saing: *Wheat Production in Myanmar* (Agriculture Corporation, Feb, 1985).
2. *History of Myanmar Lord*, Volume-1.
3. Different Series of *Report to Pyi-thu-hlut-taw*.
4. Different series of *Statistical Year Book*.
5. Official files and records of Myanma Agriculture Service.
6. Agricultural Market Information Service Project. *Commodity prices for years 2000*.