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MAIN FINDINGS

# RICE AREA AND PRODUCTION ESTIMATES FOR THE 2021 POST-MONSOON SEASON

Myanmar Agricultural Crop Yield Estimation Project

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Burma rice production is currently a major source of concern due to political unrest and high inflation rates. Rice cultivation was generally favorable in the rainy season, accounting for about 83 percent of the total yearly production. Post-monsoon (summer) season rice accounts for the remainder and is often grown using high-yield varieties, irrigation, and fertilizer. This report presents an analysis of the vegetation and climatic conditions and provide area and production estimates (including uncertainties) for the eight main rice-producing areas in Burma. Machine learning and high-resolution satellite imagery interpretation were applied to estimate the rice area for the different regions. These data were combined with yield information to estimate total post-monsoon rice production.

The main findings that this report presents are:

- Post-monsoon rice-producing areas in Bago, Mon, Shan, and Yangon are in the same range as historical data.

- There was a decline in the post-monsoon rice-producing area for Ayeyarwady, Magway, Mandalay, and Sagaing.

- The largest decline was in Ayeyarwady, with an estimated 30–40 percent decline from the previous year. Fields were barren and not cultivated with other crops.

- Post-monsoon rice area in Mandalay and Sagaing has been variable due to ongoing conflicts that started in 2021, with a low area cultivated in the post-monsoon season.

- Yields were lower than usual due to a lack of agricultural inputs, resulting in a decline in production for all regions.

- The highest decline was found for Ayeyawady, followed by Sagaing, Mandalay and Magway.
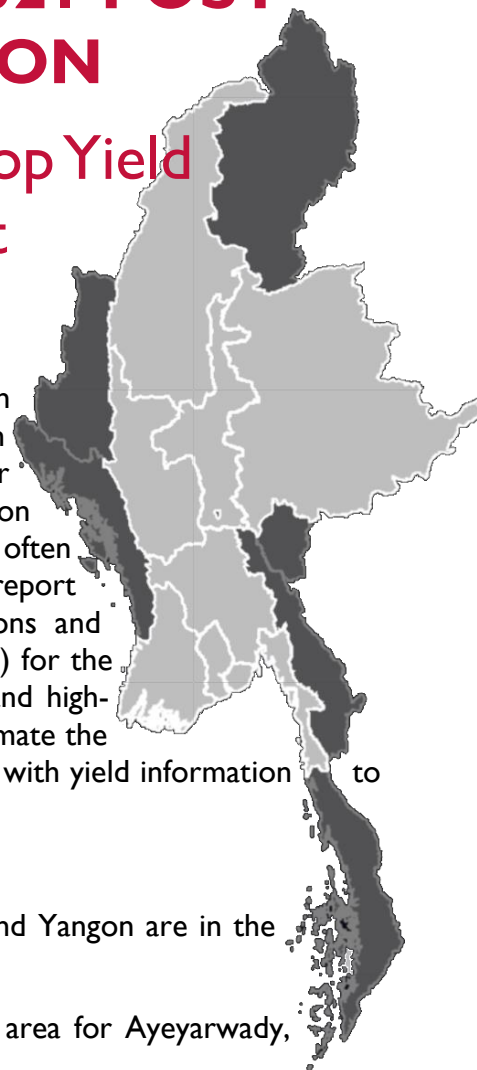
An overall decline in production of 25–40 percent from historical values can be expected at the national level due to (1) a decline in the rice-producing area due to conflict and fields left barren and (2) a drop in yields due to limited access to inputs.

1. INTRODUCTION

Burma (Myanmar) rice production is currently a major source of concern due to COVID-19-related impacts, political unrest and high inflation rates. These factors have directly impacted cash flow in supply chains, with agricultural firms facing cash flow shortages and diminished access to credit, creating greater vulnerability to economic crises. Another concern is the higher number of customers asking to purchase using credit, particularly in the Shan and Rakhine states and the Yangon Region. Overall, COVID-19 and political problems due to the military takeover have severely affected the agri-food sector of Burma, raising doubts about the performance of the agricultural sector overall and the rice sector in particular.

Analysis has shown that the 2021 monsoon-season rice production was generally in line with previous years. Weather conditions were generally favorable, and farmers were able to plant, grow, and harvest the crops with sufficient input. However, a worsening political climate has made the cultivation of crops more difficult in the post-monsoon season, and soaring prices limited the use of agricultural inputs. This report analyzes the 2022 post-monsoon rice cultivation for the regions of Ayeyarwady, Bago, Magway, Mandalay, Sagaing, and Yangon, and the states of Mon and Shan (Rakhine state was not included in the analysis as its rice cultivation was quite low). High-resolution satellite imagery from active and passive sensors was combined with a sampling approach to estimate the major post-monsoon rice areas and their production. Post-monsoon rice is primarily dependent on irrigation, limiting cultivation to the delta and areas with sufficient access to water resources from reservoirs, rivers, and lakes.

To support monitoring the food security in Burma under the impact of COVID-19 and political conflicts, this report presents an analysis of the vegetation and climatic conditions and provides area and production estimates (including uncertainties) for the eight main rice-producing areas in Burma in 2022. The report contains:

- An analysis of climate and vegetation factors for the 2022 post-monsoon season

- Area estimates (in hectares [ha]), including uncertainty levels, of rice cultivation for eight selected rice cultivating regions in Burma for the 2022 post-monsoon season

- Rice production estimates, with uncertainty levels, for those eight selected regions in Burma for the 2022 post-monsoon season

a. Post-monsoon rice season in Burma

Figure 1. Distribution of post-monsoon vs. monsoon rice sown area in Burma (left) and the percentage of the post-monsoon area used by each region (right) (SCO, 2018).

Although post-monsoon rice accounts for approximately 17 percent of the total rice cultivation area in Burma (Figure 1), it accounts for 23.4 percent of the total yearly production, according to the Central Statistical Office 2018 report (Figure 2). The larger production in relation to area is due to the generally higher yields achieved in summer. The post-monsoon rice is mainly distributed in eight regions and states in Burma, including Ayeyarwady; Yangon; Bago, Mon, Mandalay, Sagaing, Magway and Shan. The Ayeyarwady Region constitutes 52.3 percent of the post-monsoon rice production, followed by Sagaing at 14.1 percent and Bago at 12 percent (Figure 2).
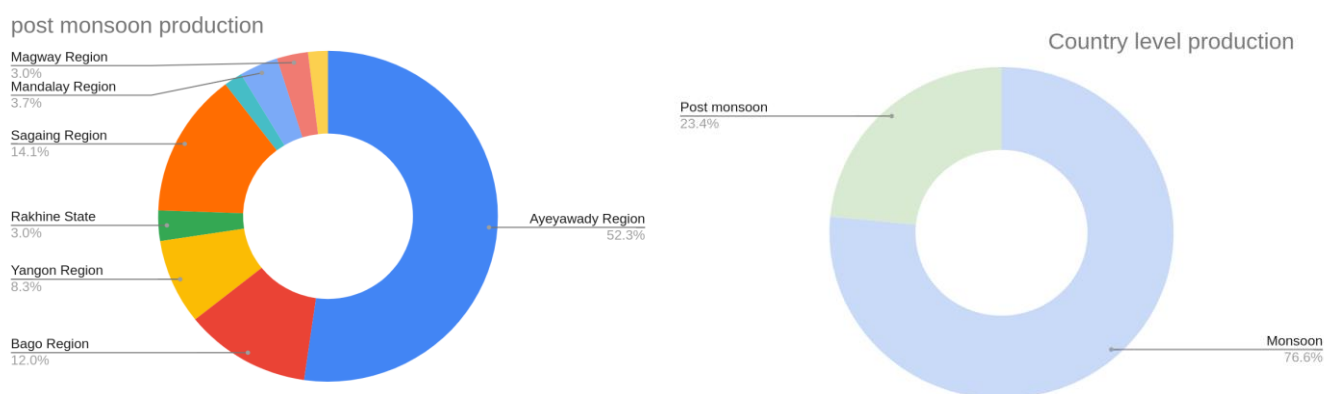

Figure 2. Distribution of total post-monsoon rice production in Burma (left) and by state and region (right).

Post-monsoon rice season in Burma grows from late December to June; however, the cultivar calendar is flexible depending on water availability. In the lowland delta and coastal regions—which include Ayeyarwady, Bago, Mon, and Yangon—rice cultivation starts between December and February. In the central dry zone and mountain upland regions, the

planting starts later (from January to March). The harvest period depends on the planting date, taking place during the months of April to June (Table 1).

Table 1. Post-monsoon cultivar calendar by state and region.

Region	Planting	Harvesting	Focus Region
Delta lowland	December–February	April–May	Ayeyarwady, Bago, Yangon
Coastal zone	December–February	April–May	Mon, Rakhine
Central dry zone, mountain and upland regions	January–March	May–June	Magway, Mandalay, Sagaing, Shan

The post-monsoon cultivated rice area is mapped using a variety of satellite data, training data, machine learning, and information from the crop calendar. Satellite sensors include passive optical and active sensors using synthetic aperture radar. All satellite data are combined and sampled, after which a machine learning method helps detect rice fields from the images. This information contributes to a stratified sampling approach, after which high-resolution satellite data are used for point interpretation. The point interpretation helps achieve an unbiased area estimate with confidence intervals for each state. In addition to the post-monsoon season, the same method of rice mapping was applied for estimating rice areas for the monsoon season of 2021. Additionally, a rainfall analysis was added for the river basins that cover Burma using the Climate Hazards Group Infra-Red Precipitation with Station Data satellite-derived precipitation product. Vegetation cover was analyzed using a Moderate Resolution Imaging Spectroradiometer-derived (MOD13A1) satellite product on the enhanced vegetation index (EVI).

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g. Sagaing Region

Croplands in Sagaing are primarily concentrated in the southern part of the region, and post-monsoon rice is grown in the areas downstream from the Thaphanzeik reservoir, which provides water for irrigation. The estimated post-monsoon rice cultivation area was much lower than historically reported numbers in the 2017–2019 period. For example, the statistical yearbook reports an area of 171,164 ha, and GAD reports a minimum of 122,767 ha. However, for 2020, GAD reported a cultivated area of 36,874 ha, whereas we estimate the 2022 rice area 45,143 ha.

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h. Shan State

A small portion of the total cropland area in Shan State is used for post-monsoon rice cultivation. We estimate the total post-monsoon rice area at 19,836 ha, whereas historically reported areas were between 21,040 and 47,435 ha. The total post-monsoon rice cultivated

area in 2022 is slightly lower compared to the numbers reported by GAD and the statistical yearbook for 2018 and 2017 but significantly lower than the numbers reported by GAD for 2019 and 2020.
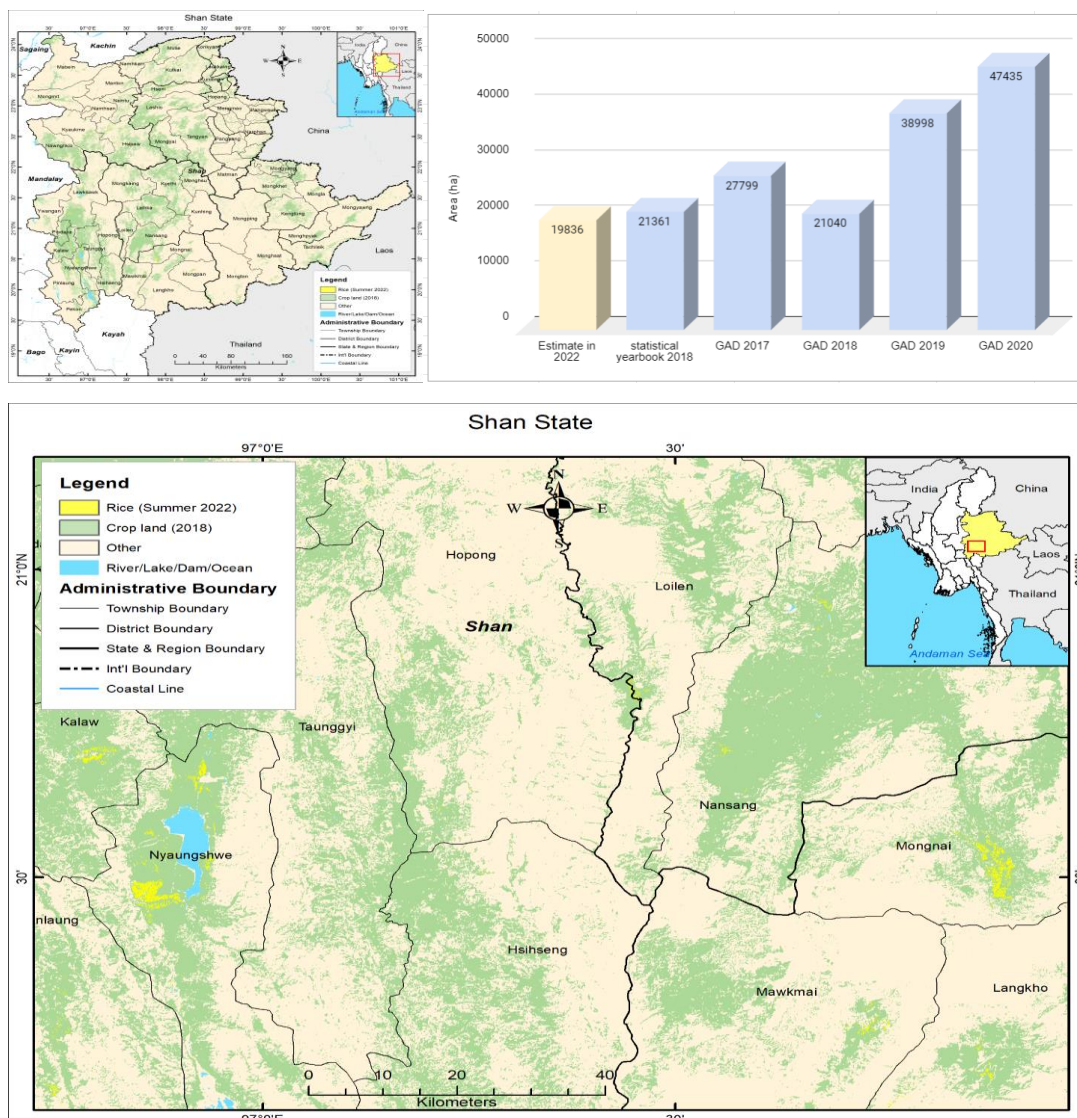

Figure 20. A post-monsoon rice map and area estimation for Shan State.

3. POST-MONSOON RICE PRODUCTION ESTIMATION

a. Rice cultivation area estimates

Table 2 shows the total rice cultivation areas with 90 percent confidence intervals as well as the GAD, U.S. Department of Agriculture (USDA), and National Statistics figures. The figures show that this report's estimate is lower than the officially reported historic numbers, with the total post-monsoon rice cultivation area for Burma estimated at 721,459 +/- 64.908 ha. This area estimate is about 25–35 percent lower than the GAD and National Statistics estimations, respectively. The most significant decreases in area were in

Ayerawady and Sagaing, followed by Magway and Mandalay. In Bago, Mon, Shan, and Yangon, cultivated areas were in line with previous years. The satellite imagery indicates that more fields remained barren in the post-monsoon season in Ayeyarwady compared to 2021. In Sagaing, cultivation has been challenging for the last couple of years due to conflict and water-related issues. Political instability and conflict could also be factors for the decrease in cultivated area in Magway and Mandalay.

Table 2. Area estimates for post-monsoon rice cultivation in Burma.

	Area (ha)	90% confidence level (ha)	GAD estimate (ha)	USDA estimate (ha)	National statistics estimate (ha)
Ayeyarwady	349,841	34,984	507,758	537,680	570,411
Yangon	81,422	6,521	78,574	81,120	86,571
Bago	152,683	13,745	174,230	117,520	124,733
Magway	23,717	1,146	16,633	47,840	50,782
Mon	19,635	1,984	14,103	18,750	19,506
Sagaing	45,143	4,047	90,096	153,920	163,242
Mandalay	29,182	1,377	43,130	38,480	40,902
Shan	19,836	2,104	37,703	19,760	21,361
Total	**721,459**	**65,908**	**962,226**	**1,015,040**	**1,077,508**

b. Rice production estimates

The rice cultivation area estimates were used to calculate rice production using the IFPRI yield information for the post-monsoon and monsoon period by state and region, calculated based on the data of households interviewed from the third Myanmar Household Welfare Survey (MHWS) in 2022 (Table 3).

Yields of post-monsoon rice are generally higher than those of monsoon rice as farmers more often use high-yield rice varieties with more fertilizer and water controlled by the irrigation system. However, the IFPRI yield estimates for the 2022 post-monsoon season are lower than in previous years as fewer agricultural inputs were used. Yields ranged from a maximum of 3,987 kg/ha for Ayeyawady to a minimum of 1,190 kg/ha for Mon.

Table 3. The indicative paddy yield estimates for the post-monsoon and monsoon periods by state and region.

State or region	Baskets per acre		Kgs per ha	
	Mean	Median	Mean	Median

Simple average all observations	662	53	3,219	2,726
Kachin	31	40	1,600	2,065
Kayah	57	50	2,960	2,581
Kayin	28	22	1,454	1,148
Chin	50	50	2,581	2,581
Sagaing	59	61	3,049	3,123
Tanintharyi	42	50	2,168	2,581
Bago	76	60	3,945	3,097
Magway	53	60	2,744	3,097
Mandalay	53	58	2,736	2,990
Mon	37	37	1,910	1,932
Rakhine	34	39	1,768	1,991
Yangon	62	67	3,223	3,442
Shan	43	40	2,203	2,065
Ayeyawady	77	60	3,987	3,097
Nay Pyi Taw	41	20	2,099	1,032

The total estimated post-monsoon rice production for 2022 is 2,623 +/- 196 thousand tons (Table 4), considerably lower than the 5,019 and 3,553 thousand tons reported by GAD and USDA, respectively. The USDA uses an expected yield of 3,500 kg/ha, whereas GAD reports yields per township, which are considerably higher. The largest decline was found for Ayeyarwady, followed by Sagaing, Mandalay, and Magway. While the cultivated area in Bago, Mon, Shan, and Yangon are quite similar to historical reported numbers, lower yields cause a decline in production. For the country, a 30–40 percent decline in total post-monsoon rice production may be due to less area having been cultivated and yields being lower than usual.

Table 4. The total 2022 production of post-monsoon rice in Burma, including the 90 percent confidence interval.

	Yield - IFPRI (kg/ha)	Production (thousand tons)	90% confidence level (thousand tons)	GAD estimate (thousand tons)	USDA estimate (thousand tons)

Ayeyarwady	3,987	1395	139	2,708	1,882
Yangon	3,223	262	21	388	284
Bago	3,945	602	54	895	411
Magway	2,744	65	3	78	167
Mon	1,910	38	4	62	66
Sagaing	3,049	138	12	452	539
Mandalay	2,736	79	4	228	135
Shan	2,203	44	5	207	69
Total	**2,975**	**2,623**	**196**	**5,019**	**3,553**

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