29th October 2015

DRUM COMMODITIES LIMITED (DCL)

COMMODITY REPORT: RICE

EXECUTIVE SUMMARY

1. This report provides a detailed examination of rice as a commodity; it was written by a member of the Drum Commodities Limited staff. The need for this report comes from the fact that rice is the second most produced grain in the world after maize, and the commodity with which DCL deals with most. The importance of rice as a key global commodity stresses the value of detailed information on the subject. This report provides this essential information, with special focus on the areas in which DCL operates.

2. Nearly half of the world eats food containing rice on a daily basis. Most of the rice we eat is the grain of the plant *Oryza sativa*, which is refined into rough, brown and white forms. As well as creating a vital human food source, rice cultivation and trade has been a powerful social and economic force throughout history. Dating back about 10,000 years, it has been a provider of staple nutrients (including essential vitamins and minerals) and employment to many of the world's rural populations.

3. On an average rice farm, two crops are produced per year. This follows a cultivation process of plant establishment in water fed environments, and careful attention including fertilizer application while the plants grow. After a crop is harvested the rice must be dried and milled, before being placed into bags and stored. During storage and transportation rice has to be kept covered and below 14% moisture in order to avoid contamination and deterioration. In order to manage quality and control trade classifications for different qualities of bagged rice are provided by the United States Department of Agriculture, and are included in the terms of trading contracts.

4. Over 90% of rice is grown within Asia, with Vietnam, India and Thailand forming the 3 biggest exporters. A grand majority of rice exports are directed towards Africa, with Nigeria forecasted to import 3.5 million tonnes of rice in 2015 making it the second largest importer of rice in the world after China. As a region Africa imports more rice than any other. The popularity of rice in Africa has been rising since the 1970s, with import figures accelerating over the last decade and a half. It has now become less of a luxury and more of a common source of affordable staple nutrition for many of Africa's impoverished areas.

5. Rice is DCL's most important commodity, forming 20% of all commodities handled since 2006. The handling of rice is continually increasing, showing trends in the growing consumption of rice in Africa and the Middle East. Detailed information on rice is provided by many organisations, including the Global Rice Science Partnership, the Food and Agriculture Organisation of the United Nations, and the United States Department of Agriculture.

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COMMODITY REPORT ON RICE

CONTENTS

1. INTRODUCTION

1.1 This report focuses on rice, a major commodity managed by DCL across Africa and the Middle East. It contains background information and definitions of different types of rice, and discusses its importance as a human food source with special reference to Africa and the Middle East. It focuses on the production process and storage criteria for rice, and details how it is classified as a commodity. Finally, it provides information on the state of the global rice market, and outlines the figures for DCL's dealings with rice since 2007.

2. BACKGROUND

2.1 Rice is the refined grain of a species of grass called *Oryza*, and is a cereal. A cereal is the name given to any type of *Poaceae* (True Grass) that is cultivated for the edible components of its grain. In their natural whole grain form, cereals are rich in minerals, vitamins, carbohydrates, fats, oils and protein. When they are refined the tissue that remains is mainly carbohydrate.

2.2 *Oryza* needs an irrigated or rain fed water source to grow effectively.

2.3 Rice is the second most produced grain in the world after maize, and is the staple food crop for over 3.5 billion people. This means that half the world's population relies on rice for 20% of their daily calories. The majority of rice consumers live in Asia, accounting for over 90% of global consumption. However, rice is also the fastest growing food staple in Africa.

2.4 Rice bears cultural importance to many culinary traditions, each having their own preferences regarding its presentation and consumption. Its societal importance means that the availability of rice is closely linked to political stability and food security in developing countries.

2.5 700 million tonnes of rice is produced annually by more than 100 countries. Certain countries in Asia and Africa rely on rice as a highly important source of government revenue and foreign exchange revenue.

2.6 The 4 major growers in the rice market are Thailand, Vietnam, the US and Pakistan. These countries account for 60-70% of total rice exports in the world.

2.7 Over 2.3 million tonnes of rice has been managed by DCL since 2006. This makes rice the commodity DCL handles most of in terms of quantity and value. Rice has been managed under DCL contracts in Benin, Cameroon, Ivory Coast, Ghana, Guinea, Kenya, Liberia, Mali, Mozambique, Nigeria, Senegal, Sierra Leone, South Africa, Togo, Uganda and Zimbabwe.

3. RICE SPECIES AND TYPES

3.1 There are 2 main types of cultivated rice grown as food throughout history. *Oryza sativa* (Asian), which is produced worldwide, and *Oryza glaberrima* (African), which is grown in parts of West Africa. *Oryza sativa* has over 40,000 different varieties.

3.2 *Oryza sativa* (Asian Rice) subspecies:

3.2.1 *Japonica*: Short and round grains, moist and sticky when cooked.

3.2.2 *Tropical Japonica*: Long, broad and thick grains.

3.2.3 *Indica*: Slender, flat grains. Dry and flaky when cooked in comparison to *japonica*.

3.3 *Oryza glaberrima*: African rice produces lower yields than Asian rice, but it shows more resilience and adaptability to severe conditions, pests and diseases. Scientist from Africa Rice Centre have produced a new variety through cross-breeding, which combines the beneficial properties of African and Asian rice. This is called NERICA, an acronym meaning New Rice for Africa.

3.4 All varieties of rice can be processed post-harvest to produce brown and white rice. Initial milling removes the husk but keeps the bran layer intact producing brown (unpolished) rice. Further milling and polishing removes the bran layer resulting in white (polished) rice. The bran layer contains proteins and minerals that makes brown rice more nutritious, as the white endosperm is mostly carbohydrate.

3.5 Black, purple and red rice are grown in many countries. Their colouration comes from anthocyanin pigments in the bran layer. These varieties are more nutritious and may have other health benefits.

3.6 Golden coloured rice is under scientific development, and is a source of vitamin A.

3.7 Grain Lengths:

3.7.1 *Short Grain*: Grain length up to 5.2mm (e.g. Japonica varieties, Arborio).

3.7.2 *Medium Grain*: Grain length between 5.2mm and 6.0mm (e.g. Bomba rice).

3.7.3 *Long Grain*: Grain length over 6.0mm (e.g. Indica varieties, Basmati, Jasmine).

3.8 Different types of rice also have a variety of other quality factors such as stickiness, aroma and flavour.

4. IMPORTANCE AND NUTRITION

4.1 It is estimated that rice is the staple food for around half of the world. In 2009, rice was recorded to have provided 19% of global human per capita energy, and 13% of per capita protein. It is unparalleled in its importance as a global food source.

4.2 Rice farming is about 10,000 years old and bears great significance in human history and culture. More land is under cultivation for rice than any other food crop, making it the most important source of employment and income for many of the world's rural people. It is grown on around 150 million farms that are mostly smaller than one hectare.

4.3 Table 1 shows the nutrition information for white and brown rice beside the values for 2 other major staple foods, wheat and maize. Brown rice is shown generally to have more beneficial nutritional value than white rice, with higher energy, fibre and protein content, and higher values of all listed vitamins and minerals except calcium. However, the fat and sugar content of brown rice is significantly higher than white rice.

Nutrient	Unit	Rice (brown, long-grain, raw)	Rice (white, long-grain, regular, raw, unenriched)	Wheat (hard red winter)	Maize / Corn Grain (yellow)
		Approximate Values per 100g			
Water	g	10.37	11.62	13.1	10.37
Energy	kcal	370	365	327	365
Protein	g	7.94	7.13	12.61	9.42
Total lipid (fat)	g	2.92	0.66	1.54	4.74
Carbohydrate, by difference	g	77.24	79.95	71.18	74.26
Fibre, total dietary	g	3.5	1.3	12.2	7.3
Sugars, total	g	0.85	0.12	0.41	0.64
Minerals					

Nutrient	Unit	Rice (brown, long-grain, raw)	Rice (white, long-grain, regular, raw, unenriched)	Wheat (hard red winter)	Maize / Corn Grain (yellow)
Calcium, Ca	mg	23	28	29	7
Iron, Fe	mg	1.47	0.8	3.19	2.71
Magnesium, Mg	mg	143	25	126	127
Phosphorus, P	mg	333	115	288	210
Potassium, K	mg	223	115	363	287
Sodium, Na	mg	7	5	2	35
Zinc, Zn	mg	2.02	1.09	2.65	2.21
Vitamins					
Thiamine	mg	0.401	0.07	0.383	0.385
Riboflavin	mg	0.093	0.049	0.115	0.201
Niacin	mg	5.091	1.6	5.464	3.627
Vitamin B-6	mg	0.509	0.164	0.3	0.622
Folate, DFE	µg	20	8	38	19
Vitamin A, RAE	µg	0	0	0	11
Vitamin A, IU	IU	0	0	9	214
Vitamin E (alpha-tocopherol)	mg	0.59	0.11	1.01	0.49
Vitamin K (phylloquinone)	µg	1.9	0.1	1.9	0.3
Lipids					
Fatty acids, total saturated	g	0.584	0.18	0.269	0.667
Fatty acids, total monounsaturated	g	1.056	0.206	0.2	1.251
Fatty acids, total polyunsaturated	g	1.044	0.177	0.627	2.163

Table 1: Key nutrition information for brown rice, white rice, wheat and corn. (Figures from the USDA Agricultural Research Service)

5. RICE IN AFRICA

5.1 Rice has been grown in West Africa for thousands of years, especially in the water fed regions of Sierra Leone, Nigeria, Mali, Ghana and Togo. West African consumer attitudes have changed over the last 30 years meaning that rice is now less of a luxury, and a source of energy for the urban poor.

5.2 Imports of rice to West Africa have been increasing since the early 1970s to combat the widening gap between supply and demand, but have not helped efforts towards regional development in this sector. However, the liberalisation of rice imports has provided cheaper, low-quality rice to the poor, and the privatisation of government managed commodity chains has improved competition and the overall quality of production.

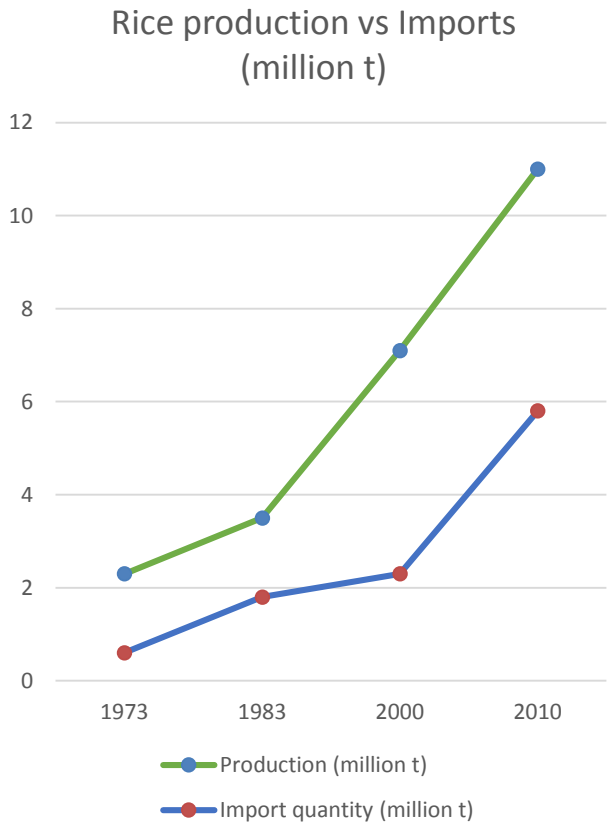
Indicator	1973	1983	2000	2010
Yield (t/ha)	1.24	1.46	1.7	1.8
Production (million t)	2.3	3.5	7.1	11
Import quantity (million t)	0.6	1.8	2.3	5.8

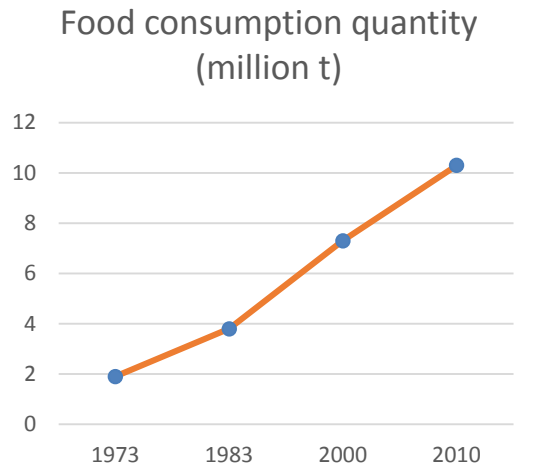
Indicator	1973	1983	2000	2010
Import value (USD million)	151	567	565	2433
Food consumption quantity (million t)	1.9	3.8	7.3	10.3

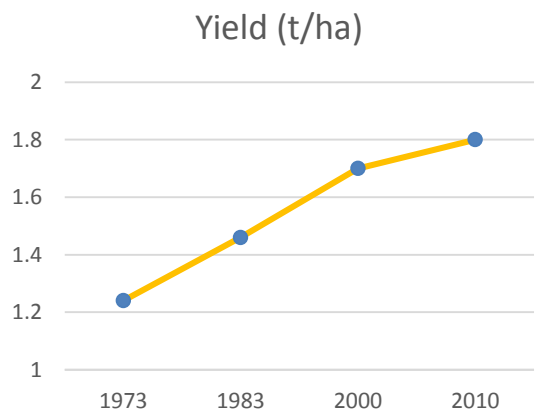
Table 2: Trends in West Africa's production, imports and consumption of rice. (Figures from GRiSP Rice Almanac)

5.3 While yield amounts slowed their increase from 2000-2010, imports sharply increased. Paired with the continual growth of consumption and production these figures show a clear increase in the demand for rice in West Africa.

5.4 The production of rice has also increased in Eastern and Southern Africa. Between 2000 and 2010 production increased by 57% from 1.19 million tonnes to 1.87 million tonnes. Average yield increased by 17.5% from 1.52 tonnes per hectare to 1.78 tonnes per hectare, and the area of production increased from 782,000 hectares to 1.047 hectares.







Figures 1, 2 and 3: Graphs drawn from Table 2, providing a picture of the rising trends of these statistics.

6. CULTIVATION AND PROCESSING

6.1 Rice grows in a wide range of environments, which is partly what makes it so effective as a staple food source. The 3 main environments are:

6.1.1 *Irrigated rice environments.* Rice plants are grown in flooded fields or paddies, which are surrounded by a small embankment to keep the water in.

6.1.2 *Rain fed lowlands.* Rice plants are grown in fields that are flooded with rainwater. These areas are affected by the inconsistency of rainfall resulting in flooding and drought. Lowland rice plantations are found in areas of the greatest poverty.

6.1.3 *Rain fed uplands.* Rice plants in upland environments can be grown in ecosystems that are incredibly diverse. Farms can be based on flat or sloping land, with a range of soil fertility levels.

6.2 Land intended for rice production must be tilled and levelled to prepare the soil for ideal crop growth conditions. This allows the seedlings to grow more easily, reduces crop management and increases yields.

6.3 Before planting, the selection of pure, clean and uniformly sized seeds is important; it can increase yields by 5-20%.

6.4 Rice plant establishment:

6.4.1 *Direct seeding*. Dry seed or pre-germinated seeds and seedlings are spread by hand or machine directly into the wet field.

6.4.2 *Transplanting*. Pre-germinated seedlings are grown in a separate nursery, and then transferred to the wet field by hand or machine. This requires more labour than direct seeding.

6.5 The 4 stages of growth are defined as:

6.5.1 *Germination.* When the seed can absorb water and is exposed to a temperature range of 10-40˚C, the first shoots and roots begin to grow.

6.5.2 *Vegetative stage.* Between 55-85 days after germination, seed grows to become a seedling with multiple leaves, which then develops tillers (new auxiliary stems) to aid the growth of the plant.

6.5.3 *Reproductive stage.* A panicle (the cluster of wind pollinated flowers at the top of the plant) emerges from the stem. Rice is at the 'heading' stage when the panicle is fully visible, which moves on to flowering, when the flowers on the panicle open and shed their pollen.

6.5.4 *Ripening.* This stage follows flowering and ends when the rice is mature and ready to harvest. Once the rice is pollinated, the grain production begins within the panicles and lasts between 15-40 days depending on the variety.

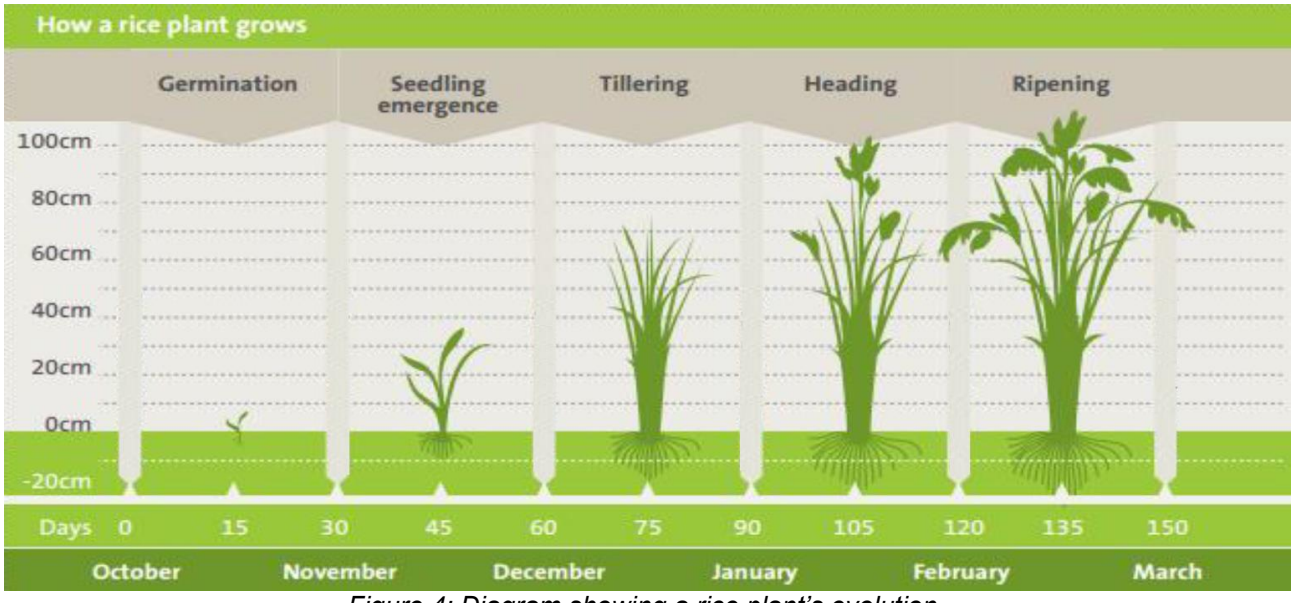


Figure 4: Diagram showing a rice plant's evolution.

6.6 It is essential to ensure that rice fields have a constant and sufficient water supply. There are many options farmers can use to aid water management such as alternating wetting and drying, raising beds and mulching. Prolonged flooding also preserves vital organic nutrients in the soil.

6.7 Limiting nutrients in soil such as nitrogen (N), phosphorus (P), potassium (K), sulphur (S), and zinc (Zn) make the careful management of fertilizer application important in rice production.

6.7.1 Fertilizer application is based on a soil composition analysis and the desired yield.

6.7.2 For soil with high phosphorus and potassium levels the most effective application method is at the final harrowing stage before seeding.

6.7.3 Soil with high nitrogen levels needs careful fertilization in order to prevent nitrogen causing vigorous plant growth and encouraging disease and infestation. In these circumstances 15-20kg of nitrogen is required for every tonne of yield. It must be spread evenly over the soil's surface.

6.8 At around 105-150 days after establishment, a rice crop will reach maturity and be ready to harvest. This means that the most efficient rice farms will produce 2 or more crops per year. Good harvesting methods (manual or mechanical) are essential to the quality of the product. Harvesting includes cutting, stacking, threshing (beating to remove the grain) and cleaning.

6.9 After harvest, rice grain contains 20-25% moisture. Drying is a crucial process as storage of incompletely dried grain will lead to failure regardless of storage conditions. When rice has reached less than 14% moisture it can be stored safely. Higher moisture levels can cause heat build-up, mould development, infestation and discolouration. Drying should take place as soon as possible after harvesting. Drying methods include:

6.9.1 *Field drying and stacking*. Rice is dried in fields or stacked in piles. This is unreliable for many reasons and should be avoided.

6.9.2 *Sun drying*. This involves spreading the grains out in the sun, and is therefore environmentally friendly. It is the most common drying method in Asia.

6.9.3 *Heated air drying (mechanical)*. This method uses drying machines to create the best drying conditions, reducing labour and producing better quality rice.

6.9.4 *In-store drying*. Rice is placed in ventilated stores for the second stage of drying, the full drying process is slow but thorough.

6.10 Rice is then milled. Milling is a process of removing the husk and bran layer from rice paddy to produce edible rice kernel. Traditionally, rice is milled using a mortar and pestle. Modern methods include the use of milling technology such as a rubber roll huskers and paddy separators. The ideal milling process will result in around 20% husk, 8-12% bran and 68-72% rice. Ideally the rice should have a minimum amount of broken kernels.

7. STORAGE AND TRANSPORTATION CRITERIA

7.1 Proper storage of rice grains is essential to the reduction of losses due to environmental factors.

7.2 Rice is occasionally transported in bulk, but throughout Asia it is stored in bags. When using bags for storage, these rules must be followed:

7.2.1 Stacked bags should be positioned under cover or water-proofing.

7.2.2 Stacks should have one metre of free space around them, and at least 1.5 metre clearance from the roof of the storage facility. This is to prevent any moisture build up around the top of the facility reaching the rice.

7.2.3 Bags should be stacked on an above ground structure such as pallets in order to avoid absorbing moisture from the storage facility's floor.

7.2.4 Bags should not be in contact with rice husks as these are hard to keep free from infestation.

7.2.5 The dimensions of stacks should be measured to ensure that they can be sealed with a single fumigation sheet. This will facilitate the process of fumigation.

7.2.6 Storage in hermetically sealed bags can improve moisture control and protection by creating an airtight capsule.

7.3 The most important qualities of a good storage facility are:

7.3.1 Protection from birds and insects.

7.3.2 Ease of access for loading.

7.3.3 Effective space management.

7.3.4 Ease of maintenance.

7.3.5 Moisture prevention.

7.4 Grain can be stored for longer periods of time if it is protected from pests and stored below 14% moisture, and seed below 12%.

7.5 The guidelines for optimum storage hygiene are:

7.5.1 Keep storage areas clean and free of spillages.

7.5.2 Clean storage rooms after they are emptied, and spray with insecticide.

7.5.3 Place rat traps and barriers in storage areas.

7.5.4 Conduct regular inspections in storage rooms.

Storage Duration	Required Moisture Content for safe Storage	Potential Problems
Weeks to a few months	14% or less	Moulds, discolouration, respiration loss, insect damage, moisture absorption
8-12 months	13% or less	Insect damage
More than one year	9% or less	Loss of germination

Table 3: Safe storage conditions for grain. (Figures from IRRI)

7.6 Rice can be transported by ship, train or road. The most important requirements for the transport of rice are for it to be kept dry, away from solar radiation and to not use hooks on bags.

7.7 Transport conditions must be cool, dry and have good ventilation.

7.8 Stowage factors for types of rice: *(Figures from the German Transport Information Service)*

7.8.1 1.359 m3/t (bulk cargo).

7.8.2 1.5 - 1.6 m^3/t (jute fabric bags, 100 kg).

7.8.3 1.81 - 1.95 m^3/t (paddy rice, bags or bulk).

7.8.4 1.34 - 1.39 m^3/t (cargo rice, bags or bulk).

7.8.5 1.39 - 1.45 m^3/t (white rice, bags or bulk).

7.8.6 1.48 - 1.56 m^3/t (broken rice, bags or bulk).

7.8.7 1.84 - 2.12 m^3/t (rice, not hulled).

7.8.8 1.44 - 1.56 m^3/t (rice, hulled).

7.8.9 1.39 - 1.56 m^3/t (rice, polished).

8. RICE AS A COMMODITY

8.1 There are no universal standards for the classification of rice as a commodity. However rice is not a fungible commodity, so cannot be traded without detailed classification systems.

8.2 The United States Department of Agriculture (USDA) has 6 levels of classification for rough and white rice, and 5 levels for brown rice. These are labelled 'U.S. No 1' to 'U.S. No 6', with 'U.S. No 1' being of the best quality.

8.3 A 500-gram sample of a rice shipment is usually taken, and the amount of excess seeds, heat-damaged kernels, discoloured kernels and other rice types are counted. The ratio of these undesirable kernels to desirable kernels determines the grading specification of the rice.

8.4 A 'Commodity Futures Contract' is an agreement to buy or sell a set amount of a commodity at a predetermined price and date. A typical contract may list a preference for the deliverable grade, such as: 'U.S. No. 2 or better'.

8.5 Refer to Annexes A, B and C for detailed data tables from the USDA showing their grading systems for rough, brown and white rice.

9. THE GLOBAL RICE MARKET

9.1 For the last 2 years rice prices have been in decline, with the current price fluctuating at around 350-450 USD per metric tonne.

9.2 Over 700 million tonnes of rice is produced annually, with this figure growing every year. 90% of this is grown in 'Rice-producing Asia' (Asia excluding Mongolia and Central Asian countries).

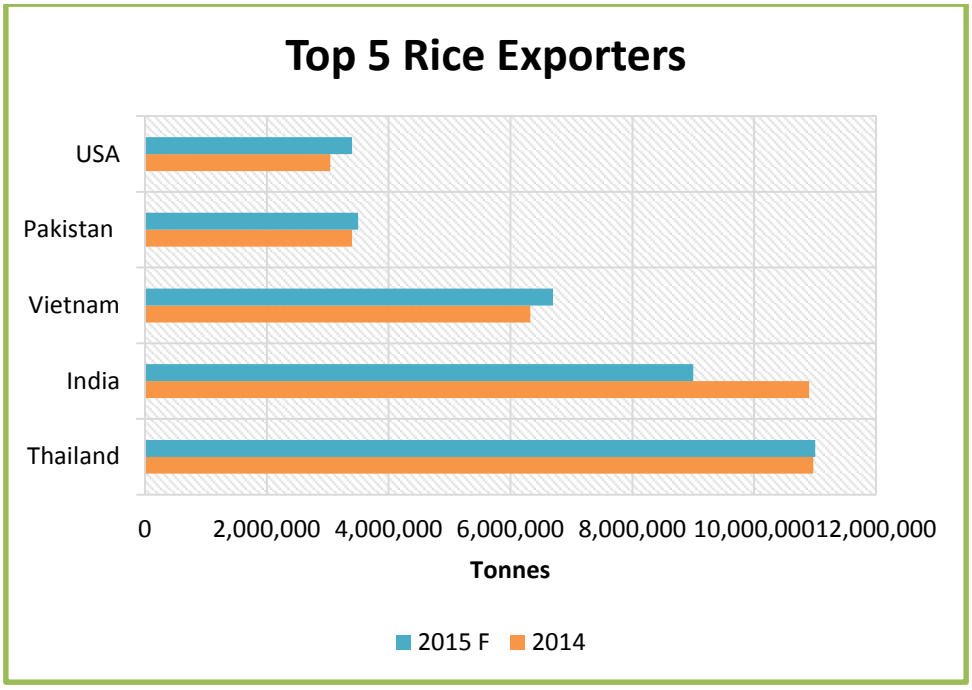


Figure 5: The top 5 exporters of rice in the world for 2014 and the forecast for 2015. (Figures from USDA Foreign Agricultural Service)

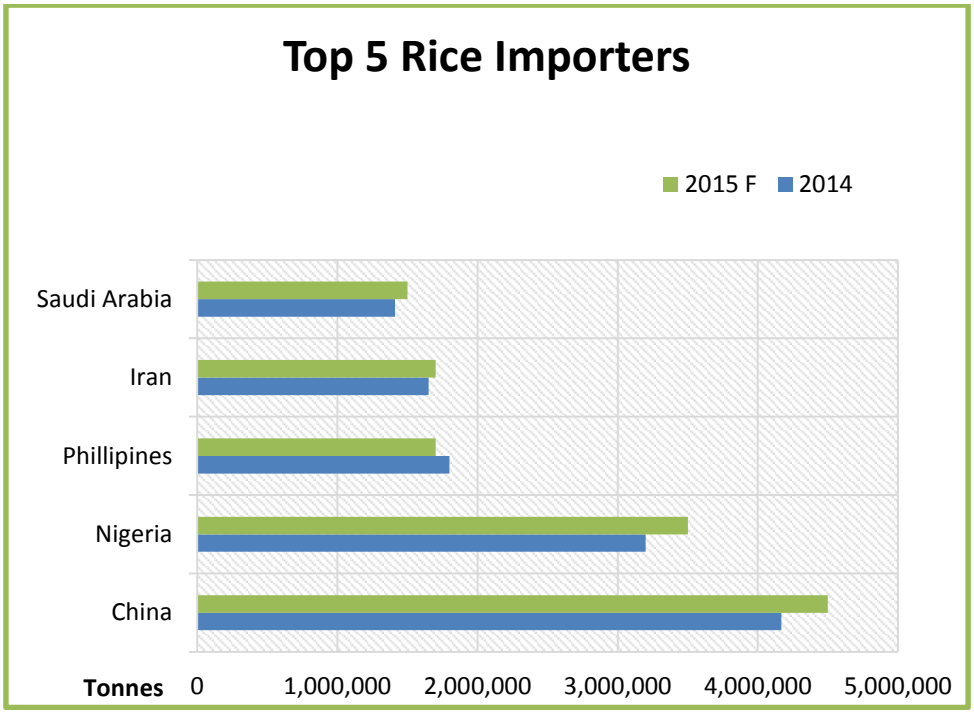


Figure 6: The top 5 importers of rice in the world for 2014 and the forecast for 2015. (Figures from USDA Foreign Agricultural Service)

9.3 Rice consumption continues to grow in Africa, outpacing domestic rice production. There has been a sharp rise since in imports since 2010 due to recovery from the economic crash and rice shortages from 2008-2009.

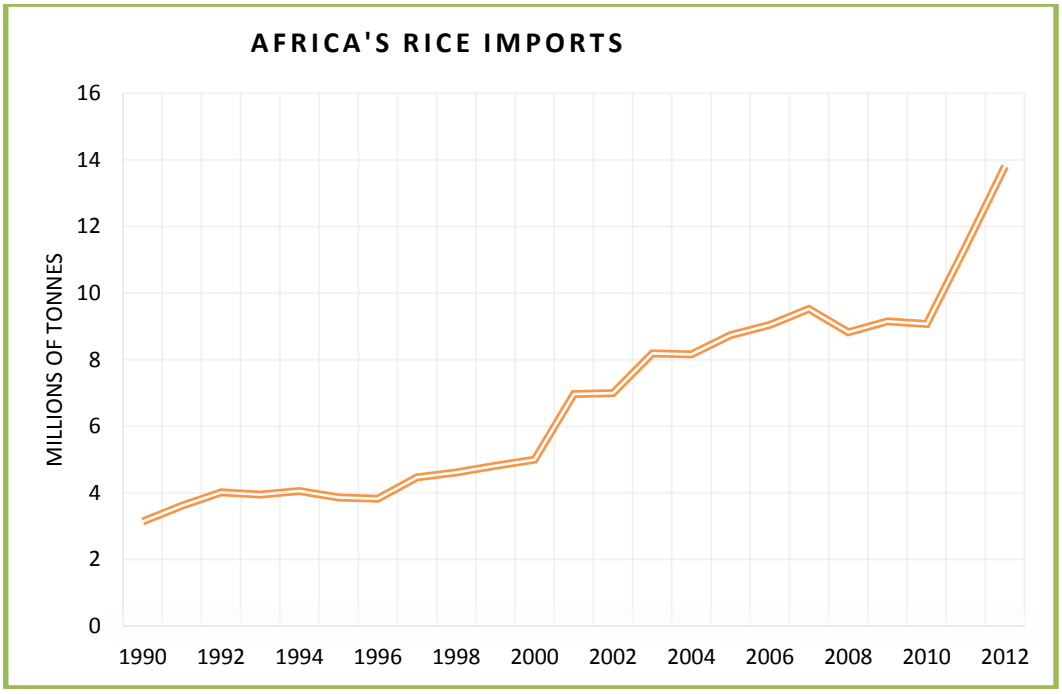


Figure 7: The tracked increase of rice imported into Africa 1990-2012. (Figures from FAOSTAT)

9.4 By continent, Africa is the largest net importer of rice, with just below 15 million tonnes being imported in 2014.

9.5 International trading firms conduct most major rice transactions. Trade is often facilitated by brokers who help link buyers to sellers. Major European brokerage firms dealing with rice include Jacksons, Maruis Brun et Fils, Schepens & Co SA.

9.6 Significant private international rice trading firms include:

9.6.1 American Rice Inc (USA).

9.6.2 Archer Daniels Midland Co. (USA).

9.6.3 Ascot Commodities (Switzerland).

9.6.4 Capital Rice Co. Ltd (Thailand).

9.6.5 Louis Dreyfus (France).

9.6.6 Novel (Switzerland).

9.6.7 Olam (Singapore).

9.6.8 The Rice Corporation, TRC (USA).

9.7 Maps analysing projected levels of global rice crop production, export and import of milled rice for 2015/2016 are shown below. *(From USDA Foreign Agricultural Service)*

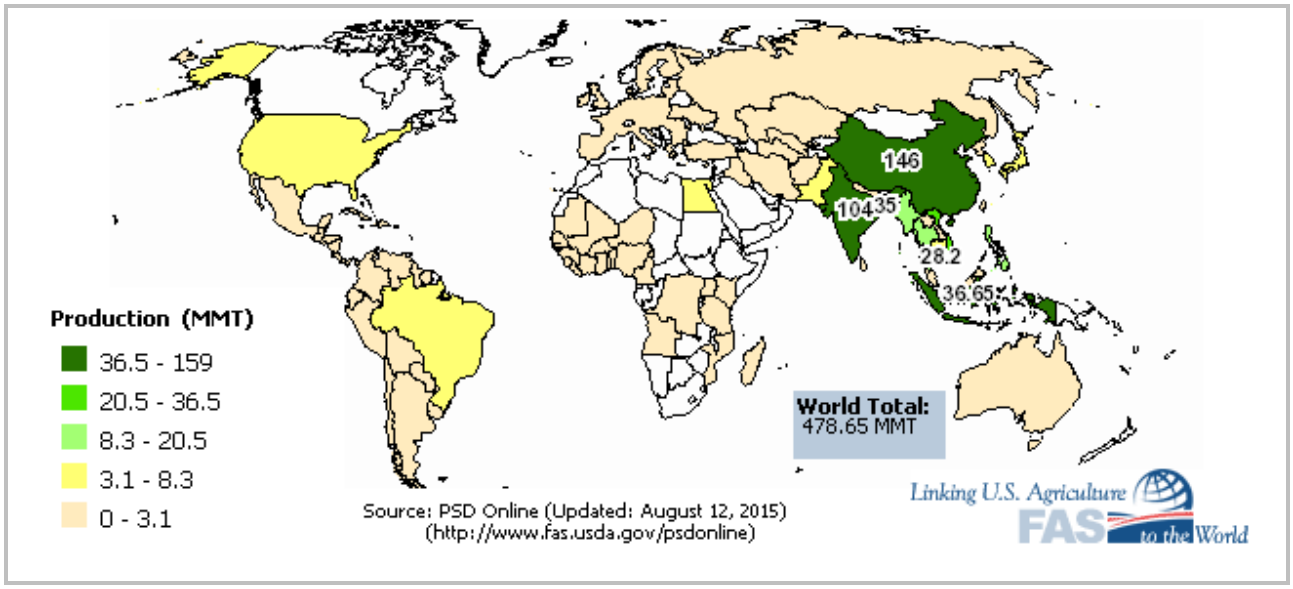


Figure 8: Production.

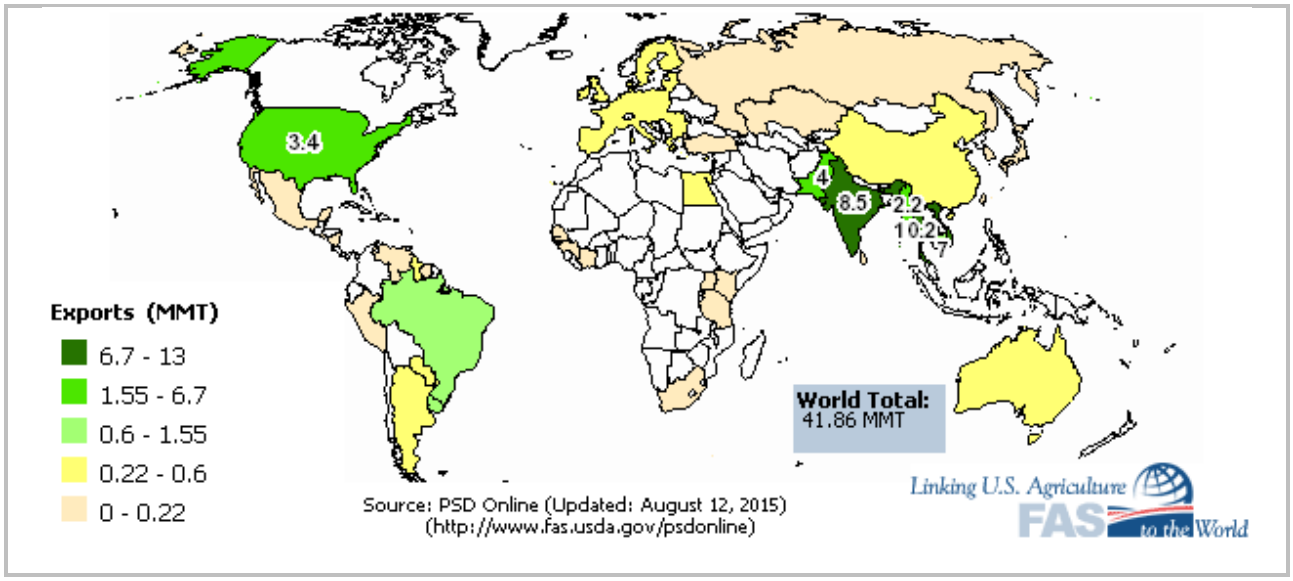


Figure 9: Export.

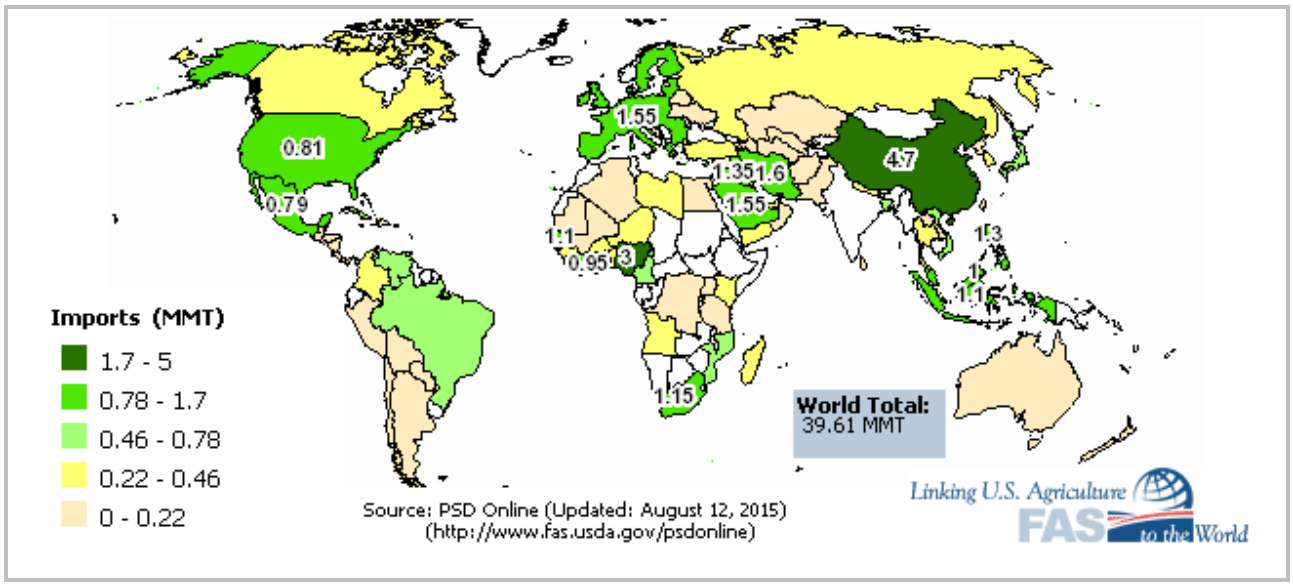


Figure 10: Import.

10. RICE AND DRUM COMMODITIES LIMITED

10.1 Rice is DCL's largest represented commodity, found under contracts in 16 countries: Benin, Cameroon, Ivory Coast, Ghana, Guinea, Kenya, Liberia, Mali, Mozambique, Nigeria, Senegal, Sierra Leone, South Africa, Togo, Uganda and Zimbabwe.

10.2 Over 2.3 million tonnes of rice have been managed by DCL since 2006, forming just under 20% of the tonnage of all commodities handled.

10.3 The greatest quantity has been managed in the Ivory Coast, with over 500,000 tonnes being handled. This is followed by Nigeria and Ghana at around 200,000 tonnes each. Figures for rice commodity management have grown exponentially since 2007 with just short of one million tonnes being handled in 2014. Figures for 2015 are to the end of July, and projections for the remainder of the year show similar amounts to 2014. However these projections do not account for fluctuations in the market compared to the first half of the year.

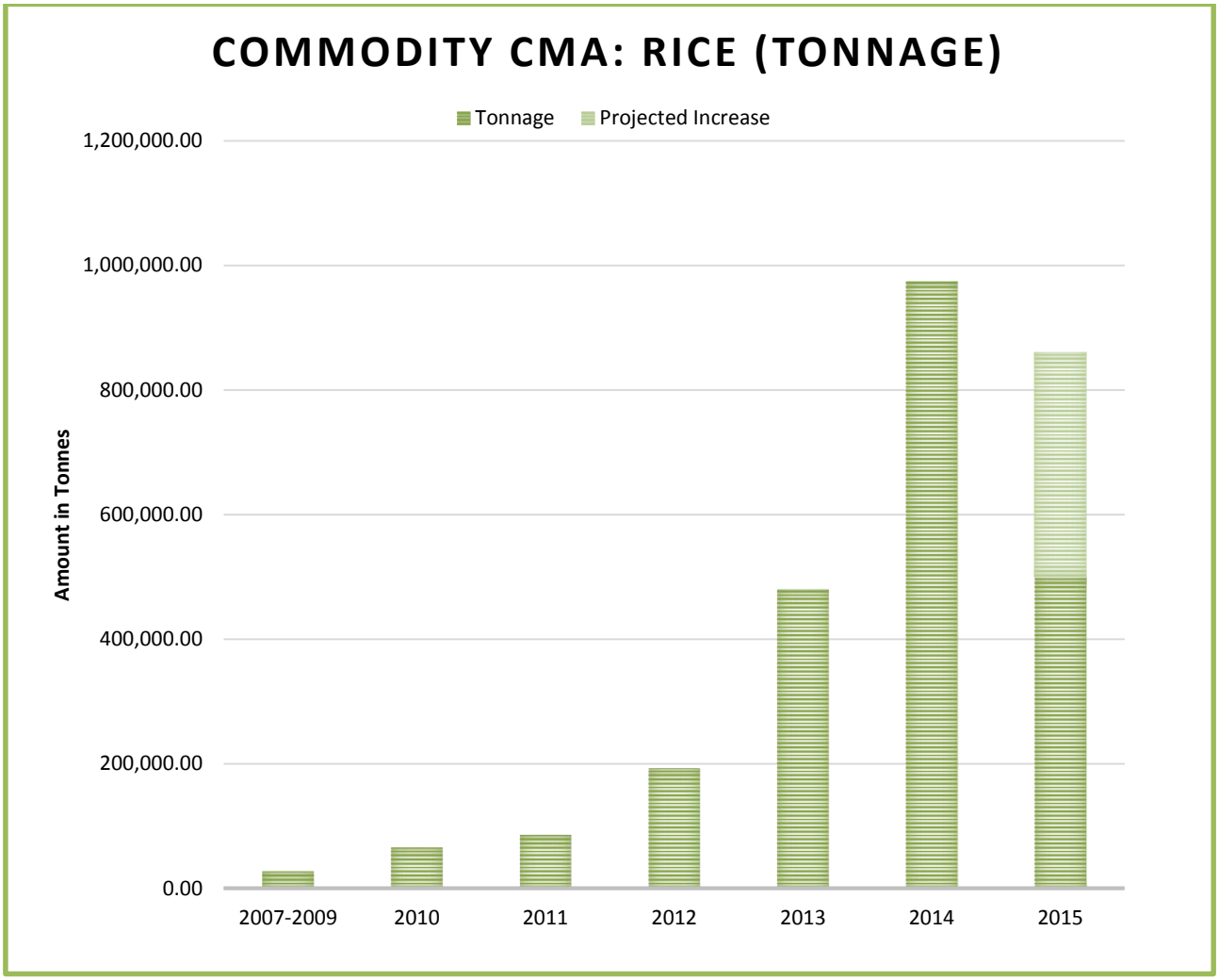


Figure 11: Commodity management, tonnage of rice 2007-2015.

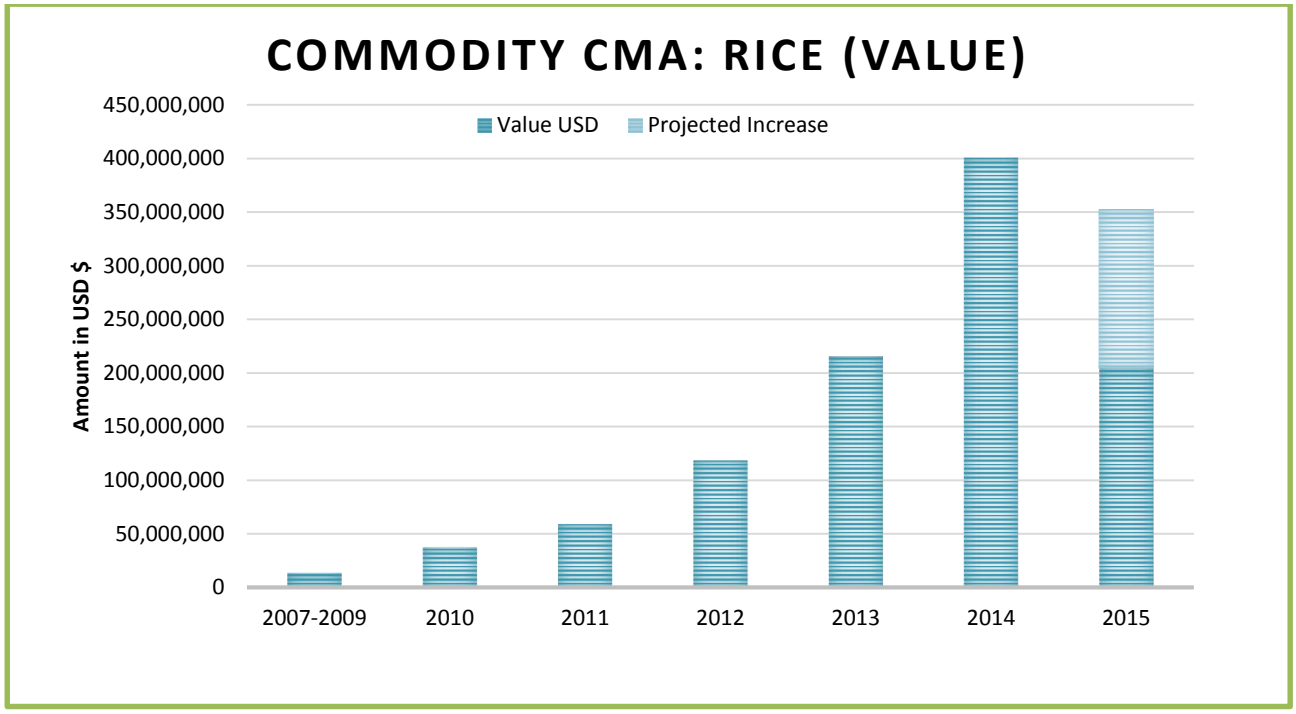
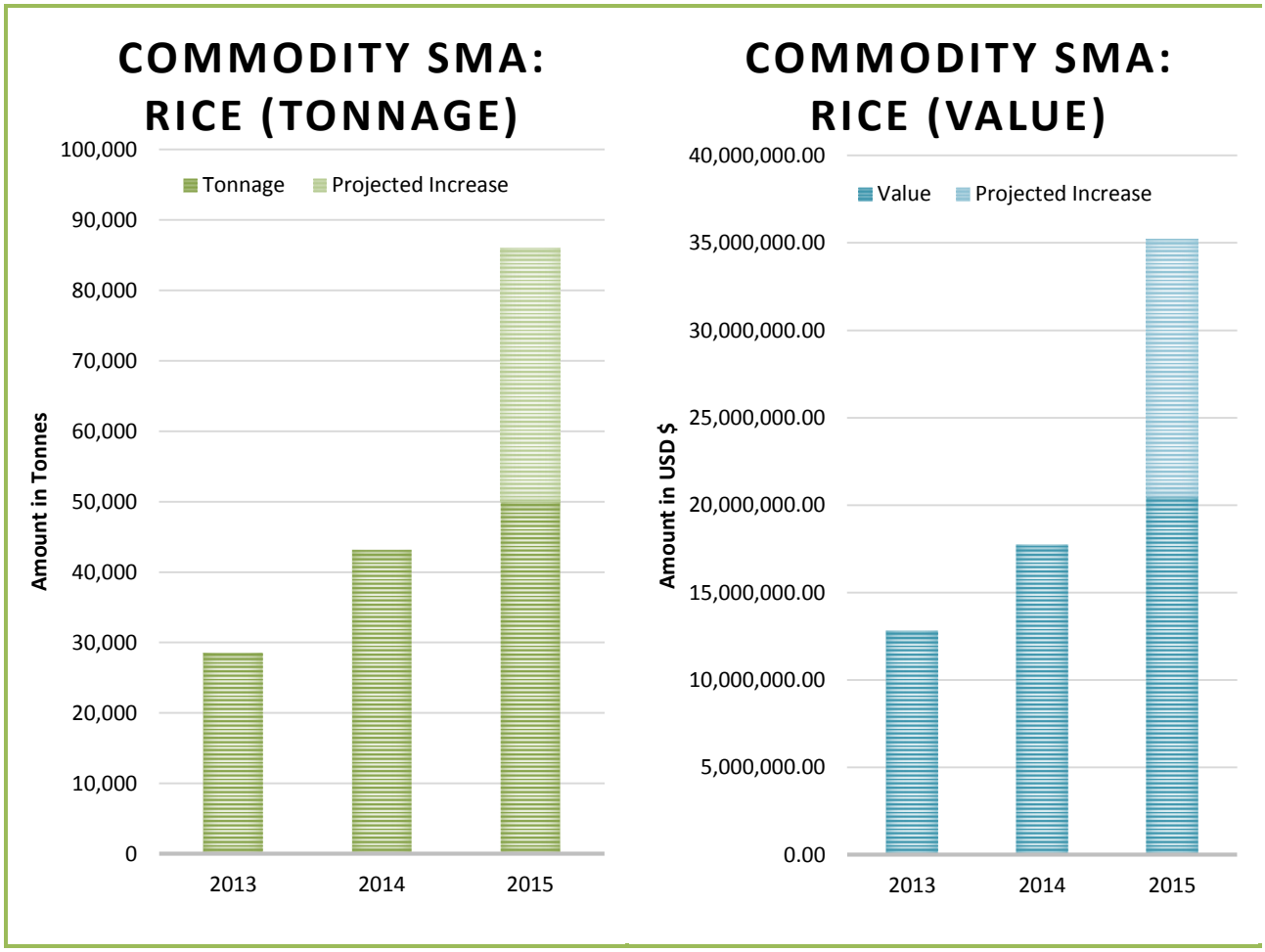


Figure 12: Commodity management, value of rice 2007-2015.

10.4 Figures for stock monitoring increased by 51% from 2013-2014 to over 40,000 tonnes. Projections for 2015 forecast a notable 99% increase.



Figures 13 and 14: Commodity stock monitoring amounts, tonnage and value of rice 2007-2015.

11. CONCLUSION

11.1 Rice is a cereal that is grown all over the world. It is an incredibly important source of staple nutrition for over 3.5 billion people.

11.2 Over 40,000 different varieties of rice stem from 2 main edible species, *Oryza sativa* and *Oryza glaberrima*. The 3 commoditized forms of rice are rough (paddy) rice, brown rice and white rice. These are classified into short, medium and long grains.

11.3 Rice is mostly produced and consumed in Asia, but it is exported all over the world. It is of particular importance to Africa, which imports more rice than any other continent. Increased availability of cheaper forms of rice have helped combat poverty and malnutrition in many parts of Africa.

11.4 Rice is a seeded crop grown in water fed environments, and production is helped by the use of fertilizers. Mechanical harvesting and drying methods help improve efficiency and reduce costs.

11.5 The optimum storage and transportation criteria for rice are presented in this report.

11.6 International grading requirements for classes of rice vary, but standards from the United States Department of Agriculture are widely accepted and are presented in this report.

11.7 At this time rice production throughout the world is constantly growing, causing the price of rice to be falling. Imports in Africa are increasing by the year, and have accelerated steeply since the economic crash and rice shortages in 2008-2009.

11.8 Drum Commodities Limited is involved in handling rice throughout Africa. Rice is the commodity that DCL handles the most, with collateral management and stock monitoring both showing an exponential increase since 2007.

11.9 The evidence presented in this report highlights the importance of rice as a major global commodity, and draws attention to trends in the growing significance of rice in Africa.

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Annex A: US standards for rough (paddy) rice.

§868.210 Grades and grade requirements for the classes of Rough Rice. (See also §868.212.)

Grade	Maximum limits of ---							Color requirements[1] (minimum)
	Seeds and heat-damaged kernels			Red rice and damaged kernels (singly or combined) (Percent)	Chalky kernels [1,2]		Other types [3] (Percent)	
	Total (singly or combined) (Number in 500 grams)	Heat-damaged kernels and objectionable seeds (singly or combined) (Number in 500 grams)	Heat-damaged kernels (Number in 500 grams)		In long grain rice (Percent)	In medium or short grain rice (Percent)		
U.S.No. 1	4	3	1	0.5	1.0	2.0	1.0	Shall be white or creamy.
U.S.No. 2	7	5	2	1.5	2.0	4.0	2.0	May be slightly gray.
U.S.No. 3	10	8	5	2.5	4.0	6.0	3.0	May be light gray.
U.S.No. 4	27	22	15	4.0	6.0	8.0	5.0	May be gray or slightly rosy.
U.S.No. 5	37	32	25	6.0	10.0	10.0	10.0	May be dark gray or rosy.
U.S.No. 6	75	75	75	15.0[4]	15.0	15.0	10.0	May be dark gray or rosy.

U.S. Sample grade---
U.S. Sample grade shall be rough rice which: (a) does not meet the requirements for any of the grades from U.S. No. 1 to U.S. No. 6, inclusive; (b) contains more than 14.0 percent moisture; (c) is musty, or sour, or heating; (d) has any commercially objectionable foreign odor; or (e) is otherwise of distinctly low quality.

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[1]For the special grade Parboiled rough rice, see §868.212(b).
[2]For the special grade Glutinous rough rice, see §868.212(d).
[3]These limits do not apply to the class Mixed Rough Rice.
[4]Rice in grade U.S. No. 6 shall contain not more than 6.0 percent of damaged kernels.
[56 FR 55978, Oct. 31, 1991]

Annex B: US standards for brown rice.

§868.261 Grade and grade requirements for the classes of brown rice for processing. (See also §868.263.)

Grade	Maximum limits of--									
	Paddy kernels		Seeds and heat-damaged kernels			Red rice and damaged kernels (singly or combined) (Percent)	Chalky kernels [1,2]	Broken kernels removed by a 6 plate or a 6 ½ sieve [3] (percent)	Other Types [4]	Well-milled kernels (percent)
	Percent	Number in 500 grams	Total (singly or combined) (number in 500 grams)	Heat-damaged kernels (number in 500 grams)	Objectionable seeds (number in 500 grams)					
U.S. No.1	---	20	10	1	2	1.0	2.0	1.0	1.0	1.0
U.S. No.2	2.0	---	40	2	10	2.0	4.0	2.0	2.0	3.0
U.S. No.3	2.0	---	70	4	30	4.0	6.0	3.0	5.0	10.0
U.S. No.4	2.0	---	100	8	35	8.0	8.0	4.0	10.0	10.0
U.S. No.5	2.0	---	150	15	50	15.0	15.0	6.0	10.0	10.0

U.S. Sample grade

U.S. Sample grade shall be brown rice for processing which (a) does not meet the requirements for any of the grades from U.S. No. 1 to U.S. No. 5, inclusive; (b) contains more than 14.5 percent of moisture; (c) is musty, or sour, or heating; (d) has any commercially objectionable foreign odor; or (g) is otherwise of distinctly low quality.

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[1]For the special grade Parboiled brown rice for processing, see 868.263(a).
[2] For the special grade Glutinous brown rice for processing, see 868.263(c).
[3] Plates should be used for southern production rice and sieves should be used for western production rice, but any device or method which gives equivalent results may be used.
[4]These limits do not apply to the class Mixed Brown Rice for Processing.
[56 FR 55979, Oct. 31, 1991]

Annex C: US standards for white (milled) rice.

§868.310 Grades and grade requirements for the classes Long Grain Milled Rice, Medium Grain Milled Rice, Short Grain Milled Rice, and Mixed Milled Rice. (See also §868.315.)

Grade	Maximum limits of ---											Color requirements [1]	Minimum milling requirements [5]
	Seeds, heat damaged, and paddy kernels (singly or combined)		Red rice and damaged kernels (singly or combined) (percent)	Chalky kernels [1], [2]		Broken kernels				Other types [4]			
	Total (Number in 500 grams)	Heat damaged kernels and objectionable seeds (Number in 500 grams)		In long grain rice (percent)	In medium or short grain rice (percent)	Total (percent)	Removed by a 5 plate [3] (percent)	Removed by a 6 plate [3] (percent)	Through a 6 sieve [3] (percent)	Whole kernels (percent)	Whole and broken kernels (percent)		
U.S.No. 1	2	1	0.5	1.0	2.0	4.0	0.04	0.1	0.1	--	1.0	Shall be White or creamy	Well milled
U.S.No. 2	4	2	1.5	2.0	4.0	7.0	0.06	0.2	0.2	--	2.0	May be Slightly gray	Well milled
U.S.No. 3	7	5	2.5	4.0	6.0	15.0	0.1	0.8	0.5	--	3.0	May be Light gray	Reasonably well milled
U.S.No. 4	20	15	4.0	6.0	8.0	25.0	0.4	1.0	0.7	--	5.0	May be Gray or slightly rosy	Reasonably well milled
U.S.No. 5	30	25	[5]6.0	10.0	10.0	35.0	0.7	3.0	1.0	10.0	--	May be Dark gray or rosy	Reasonably well milled
U.S.No. 6	75	75	[6]15.0	15.0	15.0	50.0	1.0	4.0	2.0	10.0	--	May be Dark gray or rosy	Reasonably well milled

U.S. Sample grade:

U.S. Sample grade shall be milled rice of any of these classes which: (a) does not meet the requirements for any of the grades from U.S. No.1 to U.S. No.6, inclusive; (b) contains more than 15.0 percent of moisture; (c) is musty or sour, or heating; (d) has any commercially objectionable foreign odor; (e) contains more than 0.1 percent of foreign material; (f) contains two or more live or dead weevils or other insects, insect webbing, or insect refuse; or (g) is otherwise of distinctly low quality.

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[1]For the special grade Parboiled milled rice, see §868.315(c).
[2]For the special grade Glutinous milled rice, see §868.315(e).
[3]Plates should be used for southern production rice; and sieves should be used for western production rice, but any device or method which gives equivalent results may be used.
[4]These limits do not apply to the class Mixed Milled Rice.
[5]For the special grade Undermilled milled rice, see §868.315(d).
[6]Grade U.S. No. 6 shall contain not more than 6.0 percent of damaged kernels.
[56 FR 55979, Oct. 31, 1991]