DETERMINATION OF AGRICULTURAL CHARACTERISTICS IN EACH COUNTRY USING TERRA/ASTER DATA

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ABSTRACT:

TERRA/ASTER has high resolution, large band numbers, stereoscopic ability and about 10 years observations. The regional agricultural characteristics were invested using the satellite data. The 7 paddy areas and 7 upland farming areas were studied. Most of the paddy areas are uniform by repeated rice cultivation, and upland farming areas show large differences on bare soil and high vegetation for the crop rotation. The Shonai Plain is typical paddy field area in Japan, and has well-developed irrigation and drainage systems. Sacrament Valley, California, USA is a very famous commercial rice producing area and the field size is very large. At New South Wales in Australia, upland farmong fields and paddy fields are mixed. The paddy field sizes of USA and Australia are more than ten times larger than Japanese paddy field. With regard to upland farming fields, the field size of Tokachi Plain, Vienna area, Jordan basin and Bretagne area are much smaller than that of Buenos Aires and Denver areas.

1. INTRODUCTION

In almost Asian countries, main food is rice and main agriculture is paddy rice. In European and American couturiers, main food is bread and main agriculture is winter wheat. In South Asian countries, the agricultural field sizes are small, and in America Continent, the field sizes are very large. Recently, agricultural remote sensing was largely progressed (RSSJ 2003, OECD 2004 and Akiyama etc. 2007) and we want to clearly indicate agricultural characteristics in each country using remote sensing technology.

2. ASTER DATA

For precision understanding of the local characteristics using ASTER data, we check the advantages of ASTER data, and the results are as follows,

1. High resolution and the large swath,
2. Large wavelength and many bands,
3. High level of geographical location,
4. Stereo pair images,
5. High performance at data searching system,
6. High speed at data delivery system,
7. Cheap price of data,
8. Large volume of archive data by ten years observation

Study procedure is as follows. At first, we survey targets and request the target data as level 1A using ASTER Ground Data System (GDS). Next, the level 1 data are processed to orthoimage with UTM coordination and Digital Elevation Model (DEM) is processed using SILCAT software. At last, we analyze the data for understanding localities of agriculture with package software such as ENVI, Erdas/Imagine, and PG-Steamer.

3. PADDY FIELD ANALYSIS

We analyze five paddy field areas in Asia, one in North America and one in Australia, as follows; 1)The Shonai Plains in Japan, 2)The Yangtze River delta in Middle-East China, 3)North-east Thai Plaine, Thailand, 4)Mekong Delta in Vietnam, 5)Thimphu area, Bhutan, 6)Sacrament Valley, California, USA, 7)New South Wales in Australia (Fig. 1). We perform almost same procedure at 7 areas. First, we make DEM and orthoimage from ASTER 1A data, and next, we make many composite images include 3D type. Using the colour composite images, agricultural characteristics are extracted, and summarized (Table 1).

The Shonai Plains is typical paddy field area in Japan, and has well-developed irrigation and drainage systems (Fig. 2). The Yangtze River Delta in Middle-East China is the famous paddy fields area in the world, and fishponds are increased recently. Northeast Thai Plain and Mekong Delta in Vietnam are famous to produce exporting rice. At the areas, temperature is enough for rice growth, and limitation is water supply. Northeast Thai Plain has severe dry **se**ason, and at the season, rice cannot grow. Mekong Delta area is attached South China Sea and the mouth of the Mekong River. At this area, rice grows not only in rainy season but also dry season. Bhutan is small and mountainous country. There are very small size paddy fields in Thimphu area in Bhutan. Sacrament Valley is also very famous commercial rice producing area and the field size is very large (Fig. 3). At New South Wales in Australia, upland farming fields and paddy fields are mixed, and field size is also very large (Fig. 4). At USA and

Australia, each paddy field size is almost ten times larger than Japanese paddy felid. We can easily understand that it is very difficult to make the rice at same cost in Japan and the countries.

4. UPLAND FARMING FIELD ANALYSIS

Targets areas are 1)Tokachi plain at Hokkaido in Japan, 2)Riyadh area in Saudi Arabia, 3)Jordan basin in Jordan, 4)Bretagne area in France, 5)Vienna area in Austria, 6)Buenos Aires area in Argentina and 7)Denver area in USA (Fig 1 and Table 2).

At almost Asian countries, main crop is paddy rice, and rice paddy is main land use at Japanese plain. Hokkaido Island in Japan is high latitude and it is difficult to make rice because of low temperature. Upland farming is main subject at Tokachi plain (Fig. 5). At Riyadh area in Saudi Arabia, rainfall is 25mm/year. Irrigation system is necessary for crop growth at this area. Most of the area is bare soil, and vegetation area is very small at only irrigated area. Jordan basin has small rainfall at 270mm/year, Rainy season is January to March, and most of the rainfall concentrates in this season. Main products are winter wheat and barley, vegetables, and fruits. At Bretagne area in France, field size is almost same to Tokachi area in Japan. Austria is mountainous country and the flat land area is only eastern part. In this area, the main agricultural products are cereals, fruits and vegetables at long shape fields.

Buenos Aires area in Argentina is flat delta of River Plate, and main crops are soybean, wheat and corn. Colorado Stats in USA is a part of great plain which elevation is 1000 to 2000m. Main agricultural products are corn, soybean, wheat, and cotton. The elevation of the Denver area is from 1500 to 1700m by ASTER DEM. Field sizes of Buenos Aires and Denver areas are much larger than other area such as Tokachi Plain, Vienna area, Jordan basin and Bretagne area (Fig. 5).

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Fig. 1 Target areas for paddy and upland farming fields

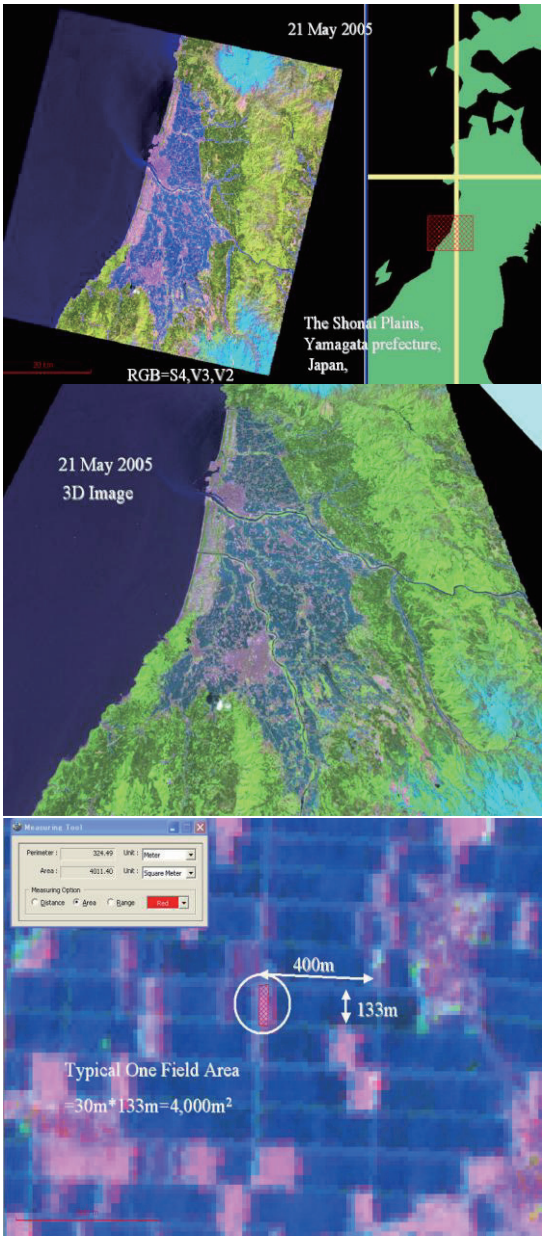

Fig. 2 Paddy fields of the Shonai Plain in Japan
Upper: Total scene of ASTER data and the map of location
Middle: 3D image of the Shonai Plain
Lower: Field size of a paddy

Table 1 Characteristics of Each Paddy Field

	Regional Topography	Growing Season	Field Size	Field Shape
Shonai, Japan	Mountainous	Summer	Middle	All Rectangle
MW-China, China	Almost Flat	Summer	Middle	Irregular & Rectangle
NE-Thai, Thailand	Very Flat	Rainy	Small	Almost Irregular
Mekong D Vietnam	Very Flat	Rainy&Dry	Small & Large	Rectangle
C-W Bhutan, Bhutan	Mountainous	Summer	Very Small	Irregular
California, USA	Flat	Summer	Large	Rectangle and Irregular
NSW, Australia	Very Flat	Summer	Large	Rectangle

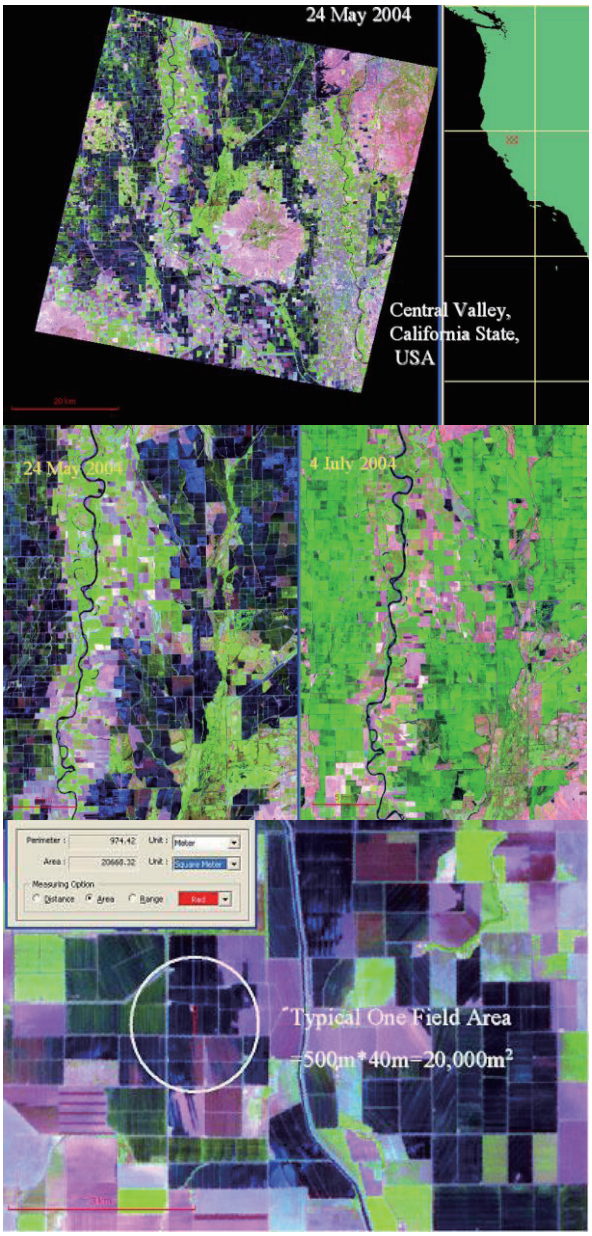

Fig. 3 Paddy fields of the California in USA
Upper: Total scene of ASTER data and the map of location
Middle: May and July Images
Lower: Field size of a paddy

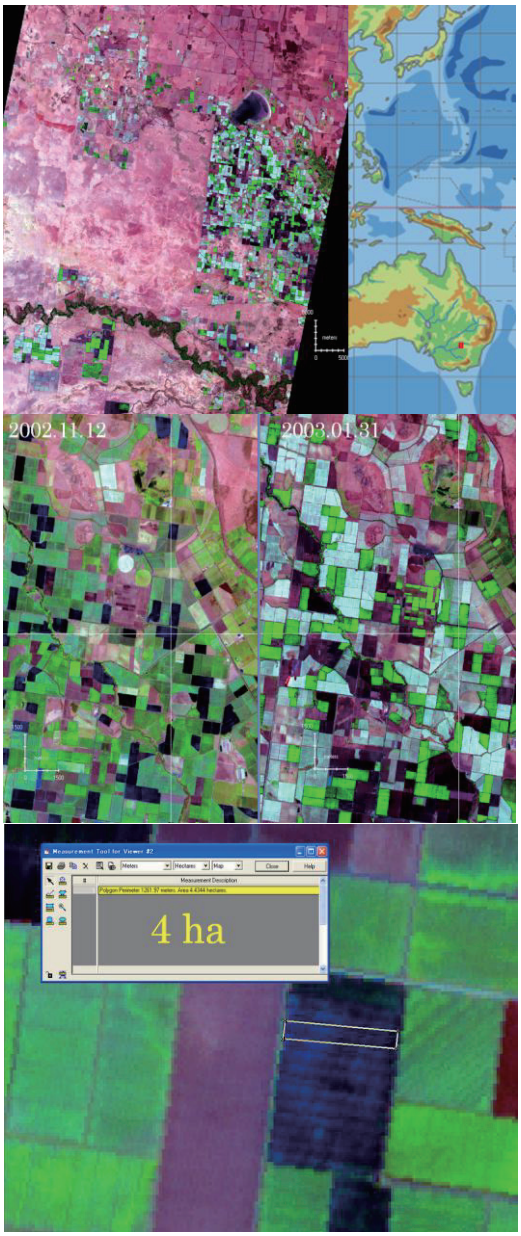

Fig. 4 Paddy fields of the South East Wales in Australia
Upper: Two scenes of ASTER data and the map of location
Middle: November and January images
Lower: Field size of a paddy

Table 2 Characteristics of Each Agricultural Field

Location	Regional Topography	Field Size	Field Shape
Tokachi, Japan	Mountainous	Small	All Rectangle
Riyadh area, Saudi Arabia	Flat	Large	Almost Circle
Jordan Valley, Jordan	Mountainous	Small	Irregular & Rectangle
Vienna, Austria	Mountainous	Middle	Almost Irregular
Bretagne aera, France	Flat	Middle	Irregular
Buenos Aires, Argentina	Very Flat	Large	Almost Rectangle
Denver, USA	Very Flat	Large	Rectangle and Cycle

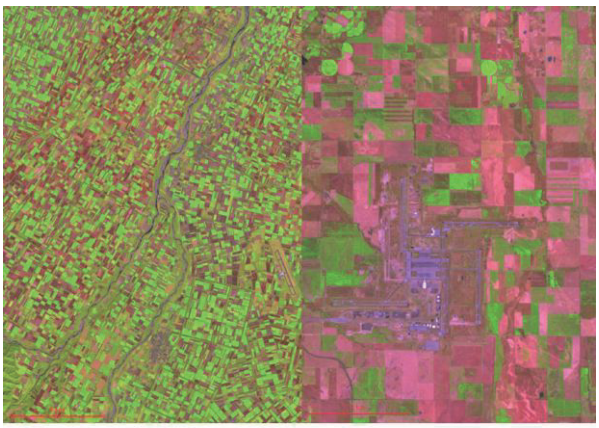

Fig. 5 Agricultural Fields in Japan and USA