Paddy rice farming (1) Planting of paddy rice

1. Growth process of paddy rice and main operations

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2. Cropping season and cultivar selection

In rice farming, 13°C is considered that the minimum temperature above which planting is possible and the temperature at which ripening stops is 15°C. Thus, planting and cropping periods are set in consideration of these temperatures. Cropping season includes normal-season culture, early-season culture, late-season culture, and double cropping. These cropping seasons are determined in consideration of many factors, including previous and next crops, avoidance of climatic hazards, effective use of machinery and facilities. Also, regionally suitable cultivars are chosen in accordance with cropping season, and in consideration of uses, quality, maturing property (early/late), disease and pest resistance, cold resistance, lodging resistance, adaptability for heavy manuring, and other properties.

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3. Raising seedlings

Japan’s rice farming mainly adopts transplanting, although direct seeding is used in some areas. Transplanting may be done using machinery or by hand; with machine transplanting, young and middle seedlings are grown in nursery boxes, while with hand transplanting, mature seedlings are grown in rice nurseries. With regard to seedlings used for machine transplanting, careful preparations and treatments are made for seedbed soil and rice seeds. Sandy loam, loam, and clay loam from mountain soil or paddy soil are suitable as seedbed soil. Soil disinfected using vapor or chemicals is sifted to grain sizes between 4 and 5 mm, and the pH is adjusted to 4.5 to 5.5 using undiluted sulfuric acid or sulfur flower. This soil is then supplemented with nitrogen, phosphoric acid, and potassium, mixed well with a bactericide to prevent damping off, and used as bed soil. Artificial bed soil and molding mats, which are commercially available for various uses, may also be used.

To select seeds, the salt water is used to select full grains (seed selection). Rice seeds that have passed the salt water selection are washed with flowing water and disinfected using chemicals to prevent the occurrence of seed-borne diseases. Then, to promote germination and full germination, rice seeds are soaked in water until the accumulated temperature reaches approximately 100°C and the bud tips grow to 1 mm long. Pretreated rice seeds are spread evenly on bed soil in the appropriate amount for the type of seedling being used, and then covered with soil. Budding may be induced by heating in a nursery cabinet or done in a greenhouse without using a heating device. Budding seedlings in nursery boxes are gradually exposed to sunlight for greening and are then hardened through temperature and irrigation control to increase resistance to low temperature.

4. Preparation of a rice field

(1) Application of organic matter and soil conditioners: To stably produce high-quality rice, the available soil depth needs to be deepened and the nutrient retaining capacity of soil increased. Specifically, prior to tillage, depending on the productivity and physicochemical properties of soil, organic materials such as straws, straw manure, stable manure, and soil conditioners, such as phosphoric acid materials, silicate materials, and lime materials, are applied.

(2) Tillage and harrowing: Tillage and harrowing are carried out using a plough or a rotary in order to promote the activity of soil bacteria by increasing the air concentration of the soil, to improve soil physical properties by maintaining optimum water content, and to bury compost, manure, stubble, and weeds in the soil. Plow tillage is suitable for ill-drained paddy fields and
weedy fields, while rotary tillage, in which tillage and harrowing are done simultaneously, is commonly used in well-drained fields. To prevent plow pan consolidation and problems caused by shallow tillage, deep tillage (15 – 18 cm deep) is done every three to four years.

(3) Puddling and leveling: After field flooding, puddling is done using a ride-on tractor or a tiller fitted with a rotary. Puddling involves harrowing and ground leveling; it facilitates water management and weed control by preventing water leakage and leveling the field, while also reducing nutrient runoff by mixing soil with fertilizer, controlling weed occurrence, and facilitating transplanting.

(4) Fertilizer application: The amount of fertilizer application is determined in accordance with not only regional fertilization standards, but also field productivity, cultivar, fertilizer type, and fertilization method. Less phosphoric acid and potassium are lost through runoff than other substances, and so applying large amounts of them has negligible negative effects on crops; therefore, whole amounts can be applied as basal dressing. However, the application of nitrogen, which has negative effects on crops when used in large quantities, is generally applied as basal dressing and topdressing. Broadcast application, in which fertilizer is applied to the entire field before tillage, is generally used. If topdressing is to be done during cultivation, surface layer application, a process by which a high concentration of fertilizer is spread in the surface layer only, is used instead. Other methods include non-split application, which uses controlled release fertilizer; side dressing, in which fertilizer is not used before puddling and is instead applied simultaneously at transplanting along lines two centimeters away from the plant lines at a depth of 3–5 centimeters; and a method in which the whole nitrogen amount necessary for growth is applied to the seedling boxes. These new methods have high fertilizer efficiency with long-lasting fertilizer effects.

5. Transplantation

Transplantation may be done mechanically or manually. With mechanical transplantation, row spacing is fixed at 30 cm, so planting density is adjusted by changing hill distance. Planting density is adjusted in accordance with location, cropping season, climatic conditions, cultivar characteristics, etc. For example, plants are densely planted in colder regions or in late-season culture to secure a sufficient number of stems. Generally, the density is 20–25 plants/m² and four to five seedlings per hill for nursing and young seedlings and 20–25 plants/m² and three to four seedlings per hill for middle seedlings. If a large number of seedlings are planted in each hill, not only are many seedlings needed, but also diseases and injuries may produce a reduced yield because of over-luxuriant growth. It is therefore necessary to use an appropriate number of seedlings per hill. Planting depth influences rooting and tillering; to ensure a sufficient number of tillers in the early stage, the planting depth should be 2–3 cm.

Manual transplantation is used for small or irregular-shaped fields; peripheral parts of fields, where machines cannot be used; as well as for supplemental planting. To plant nursery seedlings, pinch four or five seedlings between your thumb and index finger, supported lightly by your middle finger, and insert them into soil. It is important to secure a sufficient distance between rows to facilitate post-planting management and harvest works. Care should be taken to use constant numbers of seedlings per hill and planting depths. It is known that missing plants in two consecutive hills does not affect yield because plants in adjacent hills compensate for the loss. Therefore, supplemental planting should be done if plants are missing in three or more
To promote immediate rooting of the seedlings, the field is flooded immediately after transplanting and a water level of three to five centimeters is maintained. In addition, after the plants have taken root, herbicide is applied to control weeds.

- Today's practice
  Clothes:
  1) Bottom: You will be in a paddy field so you should wear trousers that can be rolled to the knees. Tight jeans are not suitable.
  2) Top: UV rays are strong in this season once the sun is up, so it is recommended that you wear long-sleeved shirts. Rice planting season has widely variable weather, so it can be very hot or very cold. You should bring a windbreaker in case it is cold. You should bring a rain wear on a rainy day.
  3) Other: You will be in a paddy field and white-colored clothes are not recommended. Mud stains are difficult to remove by washing. You should also wear a hat to avoid exposure to strong sunlight. You will need to wash your feet after the practice, so you need to bring a hand towel.

  Meeting place: In front of the Crop Work Building
  Preparation: Receive and wear your nametag. Tabi socks for underwater use (various sizes available) will be supplied in front of the Crop Work Building. You need to put on the socks before the practice starts. As you will be in a paddy field, you need to wear the tabi socks on bare feet. Please neatly line up your shoes under the overhang of the roof of the building.

  As soon as you are ready, you should move to the practice paddy fields. Roll call will be taken at the fields.

  Practice paddy fields: In the 2015 academic year, Group A will use Field No. 5 and Group B will use Field No. 6. The Agricultural and Forestry Research Center grows rice variety ‘Koshihikari’ using a certified method for environmentally friendly Specially Cultivated Agricultural Products in some of our paddy fields. The rice harvested in the Center is certified and then sold to consumers. You can purchase it, too. We will not seek certification for the rice grown in the practice fields, but the rice will be cultivated under the same fertilizer and chemical-use standards as in special cultivation fields. At the Center, in the fields that are not the special cultivation fields, rice is cultivated using conventional fertilizer use standards, but the frequency of chemical fertilizer application is significantly lower than the conventional practice in the region.

  Flow of the practice
  1) After roll call, instructions will be given to all students. You will then be divided into four groups.
  2) In each group, you will be given instructions on how to operate machines, how to transplant by hand, practice procedure, etc. You must listen carefully, as you will be doing rice plantation using machines many of you have never used before.
  3) In the paddy fields, a few lines of rice will have been already planted. There are two reasons for this: to divide the fields into areas for the groups and to help you plant rice in straight lines.
  4) Half of the members of each group move to the southern ends of the fields.
  5) Using a hand transplanter, you will plant two rows of rice simultaneously. You will form teams of two students and plant rice on one row. As can be seen in one of the photos, one student will operate the machine and another follows him/her from behind. You will swap the machine operation responsibility at the mid-point. Technical officers will accompany and aid you during the plantation practice.
6) The secret to planting rice in a straight line is not to look down. Try to look at the destination at the end of the field as you work. Rice transplanters have a marker, which marks the next planting line, but you should use this marker only as an aid. Two rows of rice will be planted simultaneously so the person operating the transplanter walks between the two rows, like walking a tightrope.

7) The student following the machine operator (i.e., next machine operator) must not walk on areas where rice plants have not been planted. He/she must walk on areas where rice plants have been planted.

8) When the machine operator hands over the operating role to the second operator at the mid-point, he/she returns to the starting point.

9) The transplanter turns around at the end of the row. This is the end of the machine transplantation practice.

10) Have a look at the row you have just planted. Is it a straight line? Are any spots missing plants?

11) If you find any spots missing rice plants in the row you have just planted, go back and plant rice by hand. The transplanter cannot be used in turning areas, so you need to plant rice in those areas by hand.

12) When waiting for your turn, you should proactively 1) supply seedlings to the transplanters, 2) level the ground in the turning areas using a ground rake, and 3) plant rice seedlings in any spots that have been missed.

13) The transplantation practice is finished when seedlings have been planted over the entire fields. You will all return to the Crop Work Building.

14) In front of the building, water and brushes will be available for you to wash your muddy feet and tabi socks. Take turns doing this. Just rinsing the outside of the tabi socks will not wash off mud from the inside, so make sure you squeeze the mud out of the socks.

15) Once you have washed your tabi socks, have them checked for cleanliness by the faculty members. Those of you who have passed this check will return your name tags and line up your tabi socks where you found them.

16) This is the end of this practice.
Specially Cultivated Rice - Specially Cultivated Agricultural Products

With the aim of maintaining and promoting the natural circulation functions of agriculture, and based on the concept of reducing the use of chemical pesticides and chemical fertilizers, specially cultivated agricultural products are cultivated using less than 50% of the chemical pesticides and chemical fertilizers than are used in conventional farming by 1) making the best of the farmland’s productivity derived from soil properties and 2) using cultivation methods that have minimal impacts on the environment. Conventional levels vary by region and cultivation method, and we use the guidelines of Ibaraki Prefecture. For rice, the prefecture's guidelines set conventional levels at 17 applications of chemical pesticides and nitrogen application at 6.4 kg/10 a; therefore, we use half of these levels, which are chemical pesticides eight times or less and nitrogen from chemical fertilizers at 3.2 kg/10 a or less.

Production of Specially Cultivated Rice at the Agricultural and Forestry Research Center

At the Center, we use pesticides four times; a process which is made possible by disinfecting rice seeds using warm water and proper amounts of pesticides in consideration of the growth of rice and the occurrence of pests. As for fertilization, we maintain the use of chemical fertilizer-derived nitrogen at 3.0 kg/10 a by using organic nitrogen. In this practice, you will learn an environmentally friendly farming practice.

Disclosure of production history using SEICA

At the Agricultural and Forestry Research Center, we make production histories public via the Internet. Agricultural products sold by the Center have access codes on them and you can confirm their production histories by entering the codes on the SEICA Website. This advanced initiative was taken up as a theme of the Kanto-Koshinetsu District University Farms Technical Training Meeting in 2007, and has also been published in journals. This year, your activities will be transmitted to the public. In the autumn, the rice you plant will be harvested, milled, packaged, and sold in the bags with a SEICA access code. This is something that you should all look forward to.

2016 Paddy Field Map, Agricultural and Forestry Research Center, University of Tsukuba