R4 Derelict farmland and rice husks

The farming workforce is shrinking, and farmland is going to ruin. Growing rice produces rice husks every year. How are these three connected, what is known, and what has not yet been measured?

Readers	Farmers, JA (Japan Agricultural Cooperatives), local governments (staff in charge of agricultural policy and the environment) and others without specialist knowledge. People who want to check the facts on the workforce, farmland and rice husks against national and prefectural figures.
Takeaways	1. The people who carry out farming in Hiroshima Prefecture (core persons mainly engaged in farming) numbered 24,534 in 2020; their average age was 72.1, and 83.5% were aged 65 or over. This average age is 4.3 years higher than the national average. Of the reasons on the owners' side why farmland becomes derelict farmland, the one that municipalities gave most often was "ageing, illness". Derelict farmland nationwide is 257,000 ha, of which 159,000 ha is expected to be difficult to return to farmland (as of 31 March 2025; the source treats the 159,000 ha and the total as reference values). 2. Growing rice produces rice husks amounting to about 20% of the weight of the unhusked rice (paddy). In Hiroshima Prefecture, calculated from the rice of the 2023 crop, this comes to about 28,000 tonnes a year (calculated value). We found no national statistics that show, use by use, how much is left unused. 3. The soil improver that the company uses is one that Professor Kuroda, our technical supervisor, made by treating the surface of rice husks and settling bacteria on them. The company used it on komatsuna in Hiroshima Prefecture. Also, together with a farm in Takehara City, Hiroshima Prefecture, the company used it against continuous cropping injury of maize (a joint trial), and has gone on using it for other crops since. There is no record of a trial on derelict farmland. There is also no record yet of a measurement of its effect in figures.
After reading	Check the area of derelict farmland in your own area, and its breakdown into land that can be restored for use and land expected to be difficult to restore, in the survey by your municipality's agricultural committee. If you use rice husks, keep a record, field by field, of the amount used and when, which field they were put into, and how the crops grew afterwards.

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This is an English translation. The Japanese edition is the authoritative text.

1. Key points

- The people who carry out farming in Hiroshima Prefecture (core persons mainly engaged in farming) numbered 24,534 in 2020; their average age was 72.1, and 83.5% were aged 65 or over. This average age is 4.3 years higher than the national average. [S2] Of the reasons on the owners' side why farmland becomes derelict farmland, the one that municipalities gave most often was "ageing, illness". [S4] Derelict farmland nationwide is 257,000 ha, of which 159,000 ha is expected to be difficult to return to farmland (as of 31 March 2025; the source treats the 159,000 ha and the total as reference values). [S4]

- Growing rice produces rice husks amounting to about 20% of the weight of the unhusked rice (paddy). [S6] In Hiroshima Prefecture, calculated from the rice of the 2023 crop, this comes to about 28,000 tonnes a year (calculated value). [S7] We found no national statistics that show, use by use, how much is left unused.
- The soil improver that the company uses is one that Professor Kuroda, our technical supervisor, made by treating the surface of rice husks and settling bacteria on them. The company used it on komatsuna in Hiroshima Prefecture. Also, together with a farm in Takehara City, Hiroshima Prefecture, the company used it against continuous cropping injury of maize (a joint trial), and has gone on using it for other crops since. [S26, S30, S25] There is no record of a trial on derelict farmland. There is also no record yet of a measurement of its effect in figures.

2. What is happening

The workforce

Nationwide, core persons mainly engaged in farming (people who are usually engaged mainly in their own farming; individual management entities) numbered 1,363,000 in 2020; their average age was 67.8, and 69.6% were aged 65 or over. [S1] In 2025 their number had fallen to 1,036,000, with an average age of 67.7, and 69.6% aged 65 or over. [S1] In 2026 it was 986,600. The source states that this value is an estimate from a sample survey, and that care is needed when comparing it directly with the values of the Census of Agriculture and Forestry (a survey of all entities). [S1]

Core persons mainly engaged in farming in Hiroshima Prefecture numbered 24,534 in 2020. This is 23.9% fewer than 5 years earlier. Their average age was 72.1, up 0.5 years from 5 years earlier (71.6) and 4.3 years higher than the national average (67.8). Those aged 65 or over made up 83.5%. [S2] The average age for the Chugoku region as a whole was 71.7, and the highest of the 5 prefectures of the Chugoku region is Yamaguchi Prefecture, at 72.3. [S1]

Agricultural management entities in Hiroshima Prefecture fell by 25.5%, from 29,929 in 2015 to 22,290 in 2020 (nationwide, a fall of 21.9%). The area of cultivated land under management of the agricultural management entities fell by 15.0%, from 34,107 ha to 28,979 ha. [S2]

In a resolution of February 2025, the Higashihiroshima City Council states that, in the questionnaire for the city's "regional plan", about 30% of the farmers and landowners who gave "scaling down or handing over the farm" as their future management want to carry it out within 5 years. [S3] The resolution does not state the year of the questionnaire or the number of people who answered.

Other prefectures show movement in the same direction. Agricultural management entities in Ishikawa Prefecture fell by 27.5% from 2015 to 2020, to 9,890. The area per entity among the entities with cultivated land under management increased by 31.3%, from 240 ares to 315 ares. [S17] Agricultural management entities in Miyagi Prefecture fell from 38,872 to 30,005, and the area of cultivated land under management fell by 3.2%, from 108,025 ha to 104,600 ha. [S18] When calculated, the area per entity in Miyagi Prefecture goes from about 2.8 ha to about 3.5 ha (calculated value; entities with no cultivated land under management are also included in the denominator). In both prefectures, the number of entities has fallen and the area per remaining entity has increased.

Farmland

The area of cultivated land nationwide reached its maximum of 6.086 million ha in 1961 and has continued to fall since; as of 15 July 2026 it is 4.21 million ha. [S5]

There are two ways of counting farmland that is no longer used, and they differ in both definition and survey method. [S4]

- Abandoned cultivated land: an area that farmers and others report themselves in the Census of Agriculture and Forestry. It means land that was cultivated before, has not been planted for 1 year or more, and is not intended to be planted again within the next few years. The survey is every 5 years; in 2015 the figure was 423,000 ha nationwide. In the 2020 Census, this survey item was dropped. [S4, S5]
- Derelict farmland: an area that municipalities and agricultural committees survey on site every year. It means farmland that has been left uncultivated and gone to ruin, so that crops can no longer be grown with ordinary farm work. Of this, land that is expected to become cultivable if trees are pulled out or the ground is levelled is classed as "can be restored for use", and land on which a return to farmland is extremely difficult, for example because it has become like a forest, is classed as "expected to be difficult to restore". [S4]

Derelict farmland nationwide is 257,000 ha as of 31 March 2025. Of this, 98,000 ha can be restored for use and 159,000 ha is farmland expected to be difficult to restore (the source treats the area expected to be difficult and the total as reference values). [S4] In 2020 it was about 282,000 ha. [S5] The values of the two ways of counting cannot be set side by side and read as a decrease.

Among the reasons for the loss of cultivated land, when the loss through dereliction (published as "abandonment of cultivation" up to 2012) is compared with the sum of four categories, namely land for factories, land for roads and railways, residential land etc., and farm and forest roads etc. (afforestation not included), it first exceeded the sum in 1995, 2 years after 1993, when the statistics began to survey these separately. It exceeded the sum every year in 1995–2006, the order changed from year to year in 2007–2012, and it exceeded the sum every year in 2013–2016. [S5] This is the result of this paper's comparison of the statistical tables. If afforestation is added as well, the first year in which it exceeds the sum becomes 1998, and in 2004–2012 it is below the sum every year. [S5] The survey of the breakdown of conversion to other uses ended with 2016. [S5] In the 2026 survey, of the 39,800 ha that ceased to be cultivated land in the preceding year, 14,500 ha was due to dereliction. [S5]

The area of cultivated land in Hiroshima Prefecture went from 108,300 ha in 1965 to 49,700 ha in 2026. [S27] Abandoned cultivated land was 11,888 ha in the 2015 Census, having increased by 5.0% from 2010 (11,325 ha). [S27] Derelict farmland is 7,047 ha as of 31 March 2025. Of this, 2,219 ha can be restored for use and 4,828 ha is farmland expected to be difficult to restore. [S5] A year earlier, the land that could be restored was 741 ha and the land expected to be difficult was 7,029 ha (7,770 ha in total). Why the breakdown moved so much in one year is not known from this table. [S5]

In Higashihiroshima City, of the 8,670 ha of farmland in the agricultural committee's farmland register (fiscal 2023), 77% is cultivated, 20% is uncropped farmland that is not planted, and 3% is derelict farmland. [S3, S27] The agricultural committee counts uncropped farmland (F farmland) separately from idle farmland (A farmland) and non-farmland (B farmland). [S27]

There are also prefectures where derelict farmland is decreasing. Derelict farmland in Miyagi Prefecture is 4,821 ha as of 31 March 2025, a decrease compared with 2020 (6,137 ha as of 30 November). [S5]

Rice husks

Rice husks make up about 20% of the weight of unhusked rice (paddy). [S6] The "harvest (for grain)" of paddy rice in the national crop statistics is the weight of brown rice sorted with a sieve of 1.70 mm mesh. [S7] The harvest (for grain) of Hiroshima Prefecture was 112,900 tonnes for the 2023 crop and 108,400 tonnes for the 2024 crop. [S7] Taking the factor for converting brown rice to unhusked rice as 0.8 (the same as in Niigata City's estimation formula), and taking 20% of that as rice husks, the rice husks of Hiroshima Prefecture come to 28,225 tonnes for

the 2023 crop and 27,100 tonnes for the 2024 crop. [S7, S6] This is this paper's own calculation, not a statistical value. Because grains smaller than 1.70 mm are not included in the harvest, the actual quantity of rice husks is likely to be slightly more than this.

The harvest (for grain) of Osaki City, Miyagi Prefecture, for the 2025 crop was 59,200 tonnes; by the same formula, the rice husks come to about 14,800 tonnes (calculated value). [S8]

Rice husks are high in carbon and low in nitrogen, and do not easily rot down. [S10] Professor Kuroda's material (chapter 5) states that rice husks improve aeration and drainage through the gaps they leave when mixed into soil, and that they take time to decompose because of their main components, cellulose and lignin. [S26] We found no public source showing the number of years they take to be decomposed in the soil. On how long they last when used as material packed into underdrains in the ground (permeable fill), the Hokuriku Regional Agricultural Administration Office gives about 10 years (shorter in districts where paddy and upland field are switched and wetting and drying are repeated) [S6], and the Miyagi Prefectural Furukawa Agricultural Experiment Station states that in paddy fields used as upland fields for 2 years or more, the 5th–6th year after the underdrain is installed is the guide for the first replenishment. [S12]

We found no national statistics showing in quantities how rice husks are handled today. What the national sources contain goes no further than the statement "about 30% of the amount produced is unused" (data for 2016) in the Hokuriku Regional Agricultural Administration Office's collection of examples, which states neither the name of the survey it is based on nor the quantities for each use. [S6] The national basic plan for promoting the use of biomass states that, taking rice straw, rice husks and the like together, about 31% is used for feed, fertiliser, bedding, fuel and so on if ploughing into farmland is excluded, and that about 92% is used if ploughing in is included (as of April 2021). [S9] There is no value for rice husks alone.

A Ministry of Agriculture, Forestry and Fisheries source states that when farmers and others who use rice husks as bedding for livestock obtain them from rice centres and the like, they mostly get them free of charge. [S10] On the other hand, there are also situations in which disposing of rice husks takes labour or costs money. The standard farm-work charges for fiscal 2024 (reference amounts) set by the Shobara City Agricultural Committee include an item "rice husk disposal", for when drying and processing are commissioned, at 10 yen per bag (30 kg). [S11]

How the three problems are connected

The decrease in the workforce and farmland falling out of use are connected. Of the reasons on the owners' side why farmland becomes derelict farmland, the one that municipalities gave most often was "ageing, illness", followed by "labour shortage" (a survey in which the Ministry of Agriculture, Forestry and Fisheries asked all municipalities in January 2021; those who answered were the municipalities, not the owners themselves). [S4]

We found no source that directly links rice husks with the problems of the workforce or farmland. Rice husks are produced every year, and returning them to the soil takes labour and time. The idea of directing rice husks to building up the soil of farmland that is no longer used is the company's own idea (chapter 5).

3. Income and costs of growing rice

Income and costs per 10 ares

The national statistics on rice production costs give, for each region, the costs, gross revenue and income per 10 ares, as the average of the individual farm management entities surveyed. [S14] The cost item "total production cost" includes the labour cost of the family's own work, interest on the farmer's own funds (imputed interest on

own capital) and rent for the farmer's own land (imputed rent on owned land). These are all costs for which money is not necessarily actually paid. [S14]

Region and crop year (per 10 ares, yen)	Total production cost	Gross revenue	Income
Hokuriku, 2023 crop	144,217	110,635	9,435
Hokuriku, 2024 crop	141,909	164,825	63,018
Chugoku, 2023 crop	160,615	94,920	△11,909
Chugoku, 2024 crop	156,827	145,192	37,902

△ means a negative figure. Gross revenue and income do not include national grants (such as the measures to stabilise farm income). [S14]

For the 2023 crop, gross revenue was below the total production cost in both Hokuriku and Chugoku. In the Chugoku region, income was also negative. [S14] For the 2024 crop, gross revenue increased, and in Hokuriku gross revenue was above the total production cost. In the Chugoku region, it is below for the 2024 crop as well. [S14] For the 2025 crop, there is only a national value in the first report, published on 30 October 2026; values by region are not included. [S14]

Differences by scale of planted area

Broadly, the smaller a farm's scale of planted area for rice, the higher its costs. The total production cost per 60 kg for the 2024 crop in the Chugoku region was 29,836 yen for farms with less than 0.5 ha planted and 11,926 yen for farms with 15 ha or more. In Hokuriku, it was 32,932 yen for less than 0.5 ha and 13,454 yen for 15 ha or more. [S14]

Looking at a prefecture's agriculture as a whole

Ishikawa Prefecture's gross agricultural output in 2023 was 52.1 billion yen, and its agricultural production income was 19.6 billion yen. [S15] Divided by the area of cultivated land in the same year, 40,100 ha, gross agricultural output per hectare is about 1.3 million yen and agricultural production income about 490,000 yen (calculated values: 1,299,252 yen and 488,778 yen). [S15, S16] Rice makes up 49.5% of Ishikawa Prefecture's output. [S15]

Hiroshima Prefecture's gross agricultural output in 2023 was 144.8 billion yen and its agricultural production income 42.6 billion yen; 47.7% of the output was livestock, and rice was 17.1%. [S15] In a prefecture with a large share of livestock, output divided by the area of cultivated land does not represent the income from growing rice. For rice growing in Hiroshima Prefecture, this paper looks not at the prefectural value but at the production cost table above for the Chugoku region (the average of 5 prefectures).

In the Noto area of Ishikawa Prefecture (Nakanoto and Okunoto), of the 4,963 agricultural management entities in 2020, 4,727 (95.2%) were individual management entities, and 2,610 (52.6%) were entities with less than 1 ha of cultivated land under management (including entities with no cultivated land under management) (calculated values). [S17] Taken together with the fact that the smaller the farm, the higher the costs, the balance of income and costs of rice growing in Noto is likely to be harsher than the Hokuriku average. This is not a value from a survey of farms in Noto.

4. Efforts so far

National policy

The national "MIDORI Strategy for Sustainable Food Systems" (May 2021) aims, by 2050, to reduce the use of chemical pesticides (risk-weighted) by 50% and the use of chemical fertilisers by 30%, and to expand the area of land under organic farming to 25% of cultivated land (1 million ha). [S19] The targets for 2030 are a 10% reduction in chemical pesticides and a 20% reduction in chemical fertilisers. [S19]

Support for restoring farmland

The national government formerly provided, through the "emergency grant for the restoration and use of abandoned cultivated land", 50,000 yen per 10 ares (up to one half of the programme cost where heavy machinery is used, and in similar cases) for restoration work such as removing weeds and scrub (as worded in the fiscal 2012 budget material). [S20] From fiscal 2026, a "derelict farmland restoration support programme" has been newly set up within the "comprehensive measures for optimal land use, part of the grant for promoting farming, mountain and fishing villages". For derelict farmland in agricultural promotion areas where the aim is to resume cultivation through discussions and other means, it supports one half of restoration work, simple land improvement, soil improvement and so on, provided the plan has a total programme cost of less than 2 million yen. The conditions include that the land is included in the regional plan within 3 years of the end of the programme. [S4, S20]

As an example of the emergency grant being used, in Tome City, Miyagi Prefecture, a new farmer who did not come from a farming family restored 0.3 ha of uncultivated paddy field with heavy machinery in fiscal 2012, installed a second-hand greenhouse the following fiscal year, and began growing medium-sized tomatoes in earnest from 2014. [S21]

As an example of a city scheme, Hiroshima City subsidises activities in which a group of 3 or more people, including local farmers, restores and uses abandoned cultivated land, up to 200,000 yen per group (subsidy rate 10/10). [S22]

Uses of rice husks

Rice husks are used as bedding for livestock, compost, permeable fill for underdrains, fuel, carbonised rice husk (kuntan) and so on. [S6]

There are also trials in which carbonised rice husk (biochar), made by turning rice husks into charcoal, is put into fields. The Miyagi Prefectural Furukawa Agricultural Experiment Station put carbonised rice husk into soybean fields and states that the more was put in, the more the carbon in the soil increased, and the soil broke up more easily and drained better (a programme in fiscal 2023–2025). [S12]

5. The rice husk soil improver, and what the company has checked

How it works

The soil improver that the company uses was made by Professor Kensuke Kuroda, our technical supervisor (Representative, Nagoya Surface Technology; Specially Appointed Professor, Institute of Innovation for Future Society, Nagoya University; supervises the company's technology as an individual), by treating the surface of rice husks and settling bacteria on them. The surface treatment turns the rice husks into a foothold for the bacteria. [S26] The treatment combines pressure, plasma, electrochemistry and other methods, and does not turn the rice

husks into charcoal. The soil improver is made in a different way from carbonised rice husk (chapter 4), which is rice husk turned into charcoal. The conditions of the treatment are not published. [S30]

Rice husks naturally carry the natto bacterium (Bacillus subtilis var. natto), but that alone does not make decomposition proceed fast enough. When the surface is treated, the original natto bacteria die. Three kinds of bacteria that help to improve the soil are then settled on the husks anew. According to the explanation in Professor Kuroda's material, the role of each is as follows. [S26]

- Photosynthetic bacteria: become nutrients for the actinomycetes and help the actinomycetes multiply
- Actinomycetes: break down cellulose, the main component of rice husks
- The natto bacterium: the material gives no explanation of its role. Because the bacteria originally present die in the treatment, it is settled on the husks again

The starting point from which Professor Kuroda conceived this soil improver was the question of whether something could be done about continuous cropping injury of maize and about rice husks. [S30] The first prototype, too, was meant to avoid continuous cropping injury in maize fields. It is intended to be used by ploughing it into the soil together with organic matter such as leaf mould. It takes a little time for the bacteria to settle and multiply. [S26]

What has been checked

Using this soil improver, the company observed in Hiroshima Prefecture that the germination and growth of komatsuna became faster. [S30] To continue testing this idea of Professor Kuroda's, the company teamed up with a farm in Takehara City, Hiroshima Prefecture. Together, the company and the farm used this soil improver against continuous cropping injury of maize (a joint trial), and have gone on using it for other crops since. [S25, S30]

The company considers that the first crop can be started about half a year after the soil improver is spread on a field, and that it takes 1 year for the rice husks to return to the soil and for the microbes to grow fully. [S25]

What has not been measured

There is no record of a measurement in figures for any of the above.

- Komatsuna: how many plants, compared with what, and by how many days it was faster
- The farm in Takehara City: the amount used, the size of the field, and how continuous cropping injury compared with fields where it was not used
- About half a year and 1 year: what was observed to decide these periods
- Changes in the amount of microbes in the soil, in crop yields, and in the properties of the soil (drainage, hardness, amount of carbon)

There is no record of the company's soil improver being used on derelict farmland. The farm in Takehara City consists of fields on which crops continue to be grown. Bringing farmland that is no longer used back into cultivation with treated rice husks is a use that the company has in mind (an idea, not yet done). [S25]

Ideas for spreading its use

The company is considering an arrangement in which equipment makers build and operate the equipment that treats rice husks, under a licence based on the amount treated. [S28] This is still at the stage of an idea.

6. The connection between land and sea

The seaweed and seagrass beds of the rocky seas of Miyagi Prefecture (rocky-reef seaweed and seagrass beds) went from 1,954.8 ha in 2015 to 867.7 ha in 2019. The 2015 figure is from a survey by the Ministry of the Environment and the 2019 figure from the prefecture's analysis of satellite images, and the times at which the images were taken differ: July–August for 2015 and November–December for 2019. [S23] The prefecture has drawn up its seaweed and seagrass bed vision on the basis of this survey. [S23]

The catch of abalone (Ezo abalone) in Miyagi Prefecture was about 150–200 tonnes before the earthquake disaster, and the average joint-sales value reached 1.2 billion yen. Since 2017 it has been below 100 tonnes. [S23] The resource management agreement for the abalone fishery in the waters of Miyagi Prefecture also states that protecting and fostering the resource is difficult, because poaching is common and the watch over the coast is not sufficient, owing to the relocation of fishers to higher ground and other reasons. [S23] The catch of abalones in Miyagi Prefecture in 2021 was 74 tonnes. [S23]

Ideas that link the resources of the land and the sea have existed before. In 2010, Miyagi Prefecture's office for the Ishinomaki area wrote that it had been demonstrated that oyster shells can be used as permeable fill for underdrains, as a soil improver and so on, but that the cost of transporting them was a bottleneck and they were not widely used. [S24]

In July 2025, the company studied on paper (a desk study) the idea of turning rice husks from Osaki City into carbonised rice husk and using it as a base for seaweed and seagrass beds on the coast of Miyagi Prefecture. [S29] There is no record of a trial in the sea. Carbonised rice husk is made in a different way from the soil improver of chapter 5. Within the scope of our research, we found no public example of carbonised rice husk being used as a base for seaweed and seagrass beds. The role of seaweed and seagrass beds and how they are decreasing are covered in R2 "Seaweed and seagrass beds and the living things of the sea".

7. What is not yet known

What we could not confirm

- There is no value from a measurement in figures of the effect of the company's soil improver (chapter 5). Nor is there any record of its use on derelict farmland.
- How much of the rice husks is left unused is not known. For the national source's "about 30% of the amount produced is unused", the original survey and the method of counting are not stated. [S6] The quantities of rice husks in this paper are calculations from the harvest.
- Sources differ in how they describe the classification under the Waste Management and Public Cleansing Act when rice husks are thrown away. The Hokuriku Regional Agricultural Administration Office's collection of examples says "if thrown away, they are industrial waste". [S6] On the other hand, among the industrial wastes in the law and regulations, plant residues (animal and plant residues) are limited to those of three industries: food manufacturing, pharmaceutical manufacturing and flavouring and fragrance manufacturing. [S13] Rice centres and country elevators come under agriculture in the industrial classification. [S13] The classification and the cost of disposal need to be checked with each local government.
- We found no public source showing the number of years it takes for rice husks to be decomposed in the soil.
- We found no source that directly links the three: the workforce, farmland and rice husks (chapter 2).
- The balance of income and costs for rice in chapter 3 is the average for farms that continue to grow crops. It is not a source that shows the income or costs after derelict farmland has been restored. The balance varies greatly from year to year (the 2023 crop and the 2024 crop).

Reliability and the publisher's position

Statistics, laws and regulations, and national and prefectural sources were checked against the published original texts. The quantities of rice husks, the gross agricultural output and agricultural production income per hectare of Ishikawa Prefecture, the area per entity in Miyagi Prefecture and the shares of entities in Noto are values that this paper calculated from statistics.

This paper started from internal research that the company carried out in 2025 (research on agriculture in Hiroshima, Miyagi and Ishikawa Prefectures, and on rice husks). When the sources were checked again for the writing of this paper, some had the wrong year, some had mixed up prefectural and city values, some used a different formula for the quantity of rice husks, and for some the original survey could not be found. For the figures in chapters 2–4 and 6, only values that could be confirmed in public sources are given.

The publisher of this paper (SeatecHIROSHIMA Ltd.) is considering a business in a soil improver made from treated rice husks, and is in a position to profit if the soil improver of chapter 5 comes into use. The mechanism in chapter 5 is based on the material of Professor Kuroda, our technical supervisor. Professor Kuroda supervises the company's technology as an individual. What was checked in chapter 5 is the company's own record. Neither has been checked by a third party.

With the rice husk soil improver, the company made the following applications. They were Hiroshima Prefecture's Hiroshima FOOD BATON in fiscal 2025 (not selected), the UBE STARTUP Business Plan Contest 2025 (finalist, no award) and the Osaki Open Innovation Pitch 2025 (did not go on to the final judging). The research on Miyagi Prefecture was prepared for the Osaki application. The research on Ishikawa Prefecture was prepared to consider a business in Noto. The company was selected for Ishikawa Prefecture's "survey project for attracting start-ups to Noto" for fiscal 2025 (Reiwa 7) (not a contest, but a survey project).

8. Sources

We examined materials published up to 25 November 2026. Every source was opened and checked on 25 November 2026. Reliability: A = laws and regulations, national and prefectural statistics and materials; B = city materials, reports of research institutions; C = materials of the company and of the technical supervisor (including materials that are not published).

ID	Source (publisher, year)	Type	Reliability	Chapters used
S1	The agricultural structure of the Chugoku and Shikoku region as seen in the 2020 Census of Agriculture and Forestry (Chugoku Shikoku Regional Agricultural Administration Office); Annual Report on Food, Agriculture and Rural Areas in Japan for fiscal 2025 (Reiwa 7), Chapter 2, Section 2 (Ministry of Agriculture, Forestry and Fisheries, 2026); Results of the 2026 (Reiwa 8) Survey on Movement of Agricultural Structure (Ministry of Agriculture, Forestry and Fisheries, June 2026) (in Japanese)	National	A	Chapter 2
S2	2020 Census of Agriculture and Forestry: summary of the results of the survey of agricultural and forestry management entities (final figures for Hiroshima Prefecture) (in Japanese) (Hiroshima Prefecture)	Prefecture	A	Chapters 1, 2
S3	Resolution on the effective use of uncropped farmland, such as abandoned cultivated land, and on preventing its spread (in Japanese) (Higashihiroshima City Council, 10 February 2025)	City	B	Chapter 2
S4	The current state of derelict farmland and measures against it (in Japanese) (Ministry of Agriculture, Forestry and Fisheries, February 2026; includes the "fact-finding survey on measures against derelict farmland" [January 2021])	National	A	Chapters 1, 2, 4

ID	Source (publisher, year)	Type	Reliability	Chapters used
S5	Farmland statistics: Area of cultivated land in 2026 (Reiwa 8) (as of 15 July) (Ministry of Agriculture, Forestry and Fisheries, October 2026); Statistics on cultivated land and planted area, time series: areas of expansion and loss of cultivated land (Ministry of Agriculture, Forestry and Fisheries); tables of derelict farmland by prefecture (2020 (Reiwa 2); fiscal 2023 (Reiwa 5); fiscal 2024 (Reiwa 6), Ministry of Agriculture, Forestry and Fisheries); Review memo on the change to the survey plan of the Census of Agriculture and Forestry (material of a subcommittee of the Statistics Commission, Ministry of Internal Affairs and Communications) (in Japanese)	National	A	Chapter 2
S6	Collection of uses and examples of the use of rice husks (in Japanese) (Hokuriku Regional Agricultural Administration Office, February 2025)	National	A	Chapters 1, 2, 4, 7
S7	Harvest of paddy rice: 2023 (Reiwa 5) crop (Hiroshima Prefecture); 2024 (Reiwa 6) crop (Chugoku region and Shikoku region) (Chugoku Shikoku Regional Agricultural Administration Office); definition of harvest (explanation of terms in the harvest of paddy rice for the 2023 (Reiwa 5) crop (Tohoku)) (Tohoku Regional Agricultural Administration Office); The state of rice husks produced in the city (Niigata City, 2015; the estimation formula) (in Japanese)	National; City	A; B	Chapters 1, 2
S8	MAFF NAVI Miyagi Vol.09 (in Japanese) (Miyagi Prefecture branch of the Tohoku Regional Agricultural Administration Office, January 2026; statistics of paddy rice by municipality for the 2025 (Reiwa 7) crop)	National	A	Chapter 2
S9	Basic plan for promoting the use of biomass (in Japanese) (decided by the Cabinet, September 2022)	National	A	Chapter 2
S10	3 Rice husks (material on bedding to replace sawdust) (in Japanese) (Livestock Industry Bureau, Ministry of Agriculture, Forestry and Fisheries)	National	A	Chapter 2
S11	Agricultural committee newsletter, No. 1 (in Japanese) (Shobara City Agricultural Committee, April 2024; standard farm-work charges for fiscal 2024 (Reiwa 6))	City	B	Chapter 2
S12	Miyagi Prefectural Furukawa Agricultural Experiment Station: Guide to packing rice husk permeable fill (technologies for extension, No. 99, fiscal 2023); Verification of the effects of biochar on crop growth and of physical properties (fiscal 2023–2025) (in Japanese)	Prefecture	B	Chapters 2, 4
S13	Order for Enforcement of the Waste Management and Public Cleansing Act (Article 2, item 4); Japan Standard Industrial Classification, 0131 grain-growing services (Ministry of Internal Affairs and Communications) (in Japanese)	Law	A	Chapter 7
S14	Rice production costs: Production costs of agricultural products (individual farm management entities): rice production costs for the 2024 (Reiwa 6) crop, comparison by national agricultural region and by year; per 60 kg by scale of planted area (Hokuriku; Chugoku) (Ministry of Agriculture, Forestry and Fisheries, March 2026); Rice production costs for the 2025 (Reiwa 7) crop (first report) (Ministry of Agriculture, Forestry and Fisheries, October 2026) (in Japanese)	National	A	Chapter 3
S15	Gross agricultural output: Gross agricultural output and agricultural production income, 2023 (Reiwa 5) (Hokuriku) (Hokuriku Regional Agricultural Administration Office, December 2024); the same (Chugoku region and Shikoku region) (Chugoku Shikoku Regional Agricultural Administration Office, December 2024) (in Japanese)	National	A	Chapter 3
S16	Statistics on cultivated land and planted area, 2023 (Reiwa 5) (in Japanese) (Ministry of Agriculture, Forestry and Fisheries)	National	A	Chapter 3
S17	2020 Census of Agriculture and Forestry: summary of the survey results (survey of agricultural and forestry management entities) (in Japanese) (Ishikawa Prefecture, March 2022)	Prefecture	A	Chapters 2, 3
S18	2020 Census of Agriculture and Forestry, survey of agricultural and forestry management entities: summary of the results (final figures) (in Japanese) (Miyagi Prefecture)	Prefecture	A	Chapter 2

ID	Source (publisher, year)	Type	Reliability	Chapters used
S19	MIDORI Strategy for Sustainable Food Systems (Ministry of Agriculture, Forestry and Fisheries, May 2021); On the setting of the 2030 targets (June 2022) (in Japanese)	National	A	Chapter 4
S20	Emergency grant for the restoration and use of abandoned cultivated land (fiscal 2012 (Heisei 24) budget); Comprehensive measures for optimal land use, part of the grant for promoting farming, mountain and fishing villages (fiscal 2026 (Reiwa 8)) (Ministry of Agriculture, Forestry and Fisheries) (in Japanese)	National	A	Chapter 4
S21	Examples of efforts to restore and use derelict farmland, 8: tomato growing by a new farmer (Tome City, Miyagi Prefecture) (in Japanese) (Ministry of Agriculture, Forestry and Fisheries)	National	A	Chapter 4
S22	Hiroshima City programme for the restoration and use of abandoned cultivated land (in Japanese) (Hiroshima City, updated February 2025)	City	B	Chapter 4
S23	On the drawing up of the Miyagi Prefecture seaweed and seagrass bed vision in fiscal 2019 (Reiwa 1) (Miyagi Prefecture, February 2021, national council on measures against barren ground (isoyake)); Resource management agreement for the abalone fishery in the waters of Miyagi Prefecture (in force from March 2024); 69th Tohoku statistical yearbook of agriculture, forestry and fisheries: marine fishery catch by species (Tohoku Regional Agricultural Administration Office) (in Japanese)	Prefecture; National	A	Chapter 6
S24	Ishinomaki NN Newsletter, No. 23 (in Japanese) (Agricultural and Rural Development Department, Eastern Regional Development Office, Miyagi Prefecture, December 2010)	Prefecture	A	Chapter 6
S25	Rice husks for better soil (in Japanese) (the company's website)	Company	C	Chapters 1, 5
S26	Material by Professor Kensuke Kuroda, "A soil improver using rice husks" (in Japanese) (September 2025, not published)	Technical supervisor	C	Chapters 1, 2, 5
S27	Farmland in the region: 2015 Census of Agriculture and Forestry: summary of the results of the survey of agricultural and forestry management entities (final figures for Hiroshima Prefecture) (Hiroshima Prefecture); Area of cultivated land (by prefecture in the Chugoku and Shikoku region) (Chugoku Shikoku Regional Agricultural Administration Office); Area of cultivated land in 2026 (Reiwa 8), table by prefecture (Ministry of Agriculture, Forestry and Fisheries); Minutes of the general meeting, March 2024 (Reiwa 6) (Higashihiroshima City Agricultural Committee; results of the farmland patrol in fiscal 2023) (in Japanese)	Prefecture; City	A; B	Chapter 2
S28	Licensing the rice husk treatment equipment (in Japanese) (the company's website)	Company	C	Chapter 5
S29	Internal research, "Additional research to make the proposal rock-solid" (in Japanese) (July 2025, not published; a desk assessment of business feasibility)	Company	C	Chapter 6
S30	The company's records of its technology and trial use (in Japanese) (internal, not published; how the treatment is described, the fact that the husks are not turned into charcoal, the starting point of Professor Kuroda's idea, the trial use on komatsuna, and the joint trial with the farm in Takehara City)	Company	C	Chapters 1, 5

Related materials

- R2 "Seaweed and seagrass beds and the living things of the sea": the role of seaweed and seagrass beds and how they are decreasing
- C2 "Solving the problems of the sea in combination": how the company uses the same surface technology in different ways at sea and on land