

The KULITIS Plant

Description

The edible kulitis (*Amaranthus spp.*) belongs to the Amaranthaceae or Amaranth family. It is an erect annual plant, strongly branching up to 2.5 m tall and with branched taproot. The leaves are alternate, with long petioles, elliptical to lanceolate or broad-ovate, dark green, light green or red and simple. Flowers are borne in axillary clusters often spherical, with a reduced but occasionally well-developed terminal spike; upper clusters are often leafless. Fruits are dry capsule, close or open. Seeds are shiny black or brown and relatively large (1200-2900 seeds/g).



Amaranthus, collectively known as amaranth (Kulitis) or pigweed, is a cosmopolitan genus of herbs. Approximately 60 species are presently recognized, with inflorescences and foliage ranging from purple and red to gold. Although several species are often considered weeds, people around the world value amaranths as leaf vegetables, cereals and ornamentals. Common names are Amaranth, Chinese spinach, Tampala, Pigweed (English) and local names are Kulitis, Uray (Tagalog) and Kudjapa (Cebu). It is an annual fast growing plant and easily cultivated in the gardens and fields.

Origin and Major Types

Amaranth is an old cultivated crop originating on American continent. The Aztecs, Incas and Mayas considered amaranth as their staple food together with maize and beans. It used to be one of the most important crops in America before Spanish colonialists conquered it and further cultivation of the crop was banned. Amaranth was preserved on hard to reach places of mountainous Central and South America. Amaranth was first introduced as an ornamental plant in Europe in the 16th century. Different species of amaranth spread throughout the world during 17th, 18th and 19th century. In India, China and under the harsh conditions of Himalayas this plant became important grain and/or vegetable crop.

Amaranth species are cultivated and consumed as a leafy vegetable in many parts of the world. There are 4 species of *Amaranthus* documented as cultivated vegetables in eastern Asia: *Amaranthus cruentus*, *Amaranthus blitum*, *Amaranthus dubius*, and *Amaranthus tricolor*.

A spiny relative of amaranth called uray (*A. spinosus* L.) is common in some regions in the Philippines.

Production trends

Amaranthus blitum is important in East Africa as a frequently collected wild plant and a popular vegetable in home gardens. The economic value as a market vegetable is limited, since market growers prefer the more productive *Amaranthus cruentus* L. and *Amaranthus dubius* Mart. ex Thell. No international trade has been reported, but probably it is occasionally imported as a vegetable by Western countries from India or East Africa.

At present amaranth is grown in the USA, South America, India, China and Russia. The Czech Republic is the most important grower in Europe (approx. 250 hectares).

Although most Filipinos grow amaranth as a green leafy vegetable, it is planted in some parts of the world for its grain. The seeds are of "moderate importance" in the Himalaya region. It was one of the staple foodstuffs of the Incas. It was also used by the ancient Aztecs and other Native America peoples in Mexico.

Kulitis is very common in the grassland sometimes in cornfields together with Saluyot. It is a weed found throughout the Philippines at lowlands and low altitudes, in open waste place, gregarious and abundant along sand bars and margins of streams.

As per record of Bureau of Agricultural Statistics (BAS) there is no any data recorder in their data base in terms of production area and volume of production of kulitis.

Uses/Importance

Nutritional Value

Amaranth is popular in India and other parts of Asia as the leaves provide two to three times the nutrients of other leafy vegetables.

Kulitis is one of the most delicious and nutritious leafy vegetables. It contains vitamins (A, B6, C, riboflavin, folate, and K) and dietary minerals (including calcium, iron, magnesium, phosphorus, potassium, zinc, and copper). Since it is very rich in iron therefore it is a good supplement for those who has anemia. Its Vitamin C and calcium contents are the best immune system booster and best for strong bones development. Iron is absorbed by the body in the presence of Vitamin C. Since this plant contains both, vitamin C supplement is not needed at all. Amaranth is also a rich source of calcium, iron and vitamin A as shown in Table 1. However their moderately high content of oxalic acid inhibits the absorption of calcium and zinc, and also means that they should be avoided or eaten in moderation by people with kidney disorders, gout, or rheumatoid arthritis.

Like the leaves, the seeds of amaranth are potent. Its protein content alone is higher than that of other world grains: amaranth, 16 percent; rice, 7-10 percent; and corn, 9-10 percent. Their combination of amino acids comes closer to a perfect protein (100) than any other major grains: amaranth's 75-87; compared with corn (44), wheat (60), and soybean (68).

Table 1. Nutritional values of amaranth
(Raw and Boiled/100 grams edible portion)

Nutrients	Raw	Boiled
Moisture (%)	84.4	83.9
Food energy (cal)	47.0	27
Protein (g)	4.6	4.4
Fiber (g)	1.1	-
Total Carbohydrates	7.4	4.4
Ash (g)	2.5	-
Calcium (mg)	341.0	314.0
Phosphorous (mg)	76.0	62.0
Iron (mg)	18.0	-
Sodium (mg)	51.0	-
Potassium (mg)	443.0	-
Vit A (I.U.)	12,860	12,345
Thiamine (mg)	0.01	0.01
Riboflavin (mg)	0.37	0.33
Niacin (mg)	1.80	1.70
Ascorbic acid (mg)	120.0	109.0

In addition, amaranth grain is high in lysine, a limiting amino acid in many proteins. A combination of amaranth and corn, for instance, scores an almost perfect 100.

Health Benefits

Many wild *Amaranthus* species are used as pot herbs. Used as ornamentals are *A. tricolor*

forms with red, yellow and green-colored leaves or leaf sections and *A. cruentus* with large bright red inflorescences. *Amaranthus* weeds are used as fodder (pigweed). Vegetable amaranths have medicinal properties good for young children, lactating mothers and patients with fever, hemorrhage, anemia or kidney problems. It has considerable amount of potassium in the leaves that might explain *kulitis* diuretic properties. Also, the potassium maintains the proper electrolyte and acid-base balance in the body. Likewise it has high fiber content which help remove the toxins and eliminate body wastes. The wild *A. spinosus* L. is used as a cure against venereal diseases and as dressing on boils.

Several studies have shown that like oats, amaranth seed or oil may be of benefit for those with hypertension and cardiovascular disease; regular consumption reduces blood pressure and cholesterol levels, while improving antioxidant status and some immune parameters.

Culinary Importance

It is used in stews, sinigang and other dishes whenever spinach (*Spinacea oleracea* L.) is not available.

Amaranth grains may be popped and eaten like popcorn (called alegrias in Mexico, laddoos in India and Pakistan), popped and ground into a delicious nutty-tasting flour, or ground without popping. Pancake-like chapatis made from amaranth flour is reportedly a staple in the Himalayan foothills.

Also, amaranth is an excellent feed for ducks. A lady farmer from the Visayas used chopped and macerated mechanically *kulitis* to feed her 35,000 Cherry Valley ducks.

Crop varieties

Based on the literature the following are locally known varieties of *kulitis* that commonly used in the Philippines for food.



***Amaranthus cruentus* L.** (Red/Purple/Blood-leaf) – *Amaranthus cruentus* is a flowering plant species that yields the nutritious staple amaranth grain. It is one of three *Amaranthus* species cultivated as a grain source, the other two being *Amaranthus hypochondriacus* and *Amaranthus caudatus*. In Mexico, it is called *huautli* and *alegría* and in English it has several common names, including blood amaranth, red amaranth, purple amaranth, prince's feather and Mexican grain amaranth. In Maharashtra, it is called as *shravanimath*. It is a tall annual herb topped with clusters of dark pink flowers. The plant can grow up to 2 m (6 ft) in height, and blooms in summer to fall. It is believed to have originated from *Amaranthus hybridus*, with which it shares many morphological features. The plant is usually green in color, but a purple variant was once grown for use in Inca rituals.

***Amaranthus blitum* L.** – commonly called purple amaranth or slender amaranth is an annual plant species in economically important plant family *Amaranthaceae*. An herb that is small and stunted to rather tall and erect, up to 100 cm tall; stem simple or branched, glabrous. Leaves arranged spirally, simple without stipules; petiole 1–10 cm long; lamina angular ovate, 1–10 cm × 0.5–6 cm, shortly cuneate at base, notched at apex, entire, glabrous, green or more or less purple, pinnately veined. Inflorescence an axillary many-flowered cluster, forming a false spike at apex of plant, with male and female flowers intermixed; bracts up to 1 mm long. Flowers unisexual, sessile, with 3(–5) tepals up to 1.5 mm long; male flowers with 3 stamens opposite tepals; female flowers with superior, 1-celled ovary crowned by (2–)3 stigmas. Fruit a sub-globular to broadly ovoid-



ellipsoid capsule c. 2 mm long, indehiscent or bursting irregularly, crowned by stigmas, 1-seeded. Seed lenticular, up to 1.5 mm in diameter, glossy dark brown to black.

***Amaranthus dubius* C. Mauritius** - is a weedy plant widespread throughout the humid lowland tropics. It originates from tropical America, where it is common in the Caribbean region and from southern Mexico to northern South America. The cultivated type may have been developed from the weedy ancestor in tropical Asia (Indonesia, India) and is found in several African and Central American countries, where immigrants have introduced it. *Amaranthus dubius* is a protected weed used as a pot herb in many African countries, and it possibly occurs in all African lowland areas. It is a cultivated vegetable in West Africa (Sierra Leone, Ghana, Benin, Nigeria), Central Africa (Cameroon, Democratic Republic of Congo), and East Africa (Kenya, Uganda), but is much less common than *Amaranthus cruentus* L.



Erect annual herb, up to 150 cm tall; stems slender to stout, branched, glabrous or upwards, especially in the inflorescence, with short to rather long hairs. Leaves arranged spirally, simple, without stipules; petiole up to 8.5(-12) cm long; lamina ovate or rhomboid-ovate, 1.5-12(-22) cm × 0.7-8(-14) cm, cuneate at the base, blunt or retuse at apex, mucronate, entire, glabrous or shortly pilose, sometimes the centre of the lamina blotched red. Inflorescence spikelike or paniculate, axillary and terminal, the terminal one up to 25 cm long, consisting of glomerules more or less isolated at base of inflorescence and agglomerated towards apex; bracts up to 2.5 mm long, awned. Flowers unisexual, subsessile, with (4-)5 tepals up to 2.5 mm long; male flowers usually near apex of inflorescences, with 5 stamens c. 2 mm long; female flowers with superior, 1-celled ovary crowned by 3 stigmas. Fruit an ovoid-urceolate capsule c. 1.5 mm long, with a short inflated beak below the stigmas, dehiscent circularly, the lid strongly rugulose below the beak, 1-seeded. Seed lenticular, compressed, c. 1 mm long, black.



***Amaranthus tricolor* L.** - *Amaranthus tricolor* originates from tropical Asia. In South and South-East Asia it is one of the major leaf vegetables and the most important *Amaranthus* species. Its domestication took place in prehistoric times and the wild ancestor is not known. Weedy plants of *Amaranthus tricolor* can be found occasionally. They are recently escaped from cultivation, since *Amaranthus tricolor* is far from competitive with true weeds. *Amaranthus tricolor* occurs as a quite rare exotic vegetable in several African countries, apparently introduced by Indian immigrants and occasionally cultivated around the big cities, especially in East and southern Africa. Its cultivation has been reported from Benin, Nigeria, Kenya and Tanzania.

Ascending or erect annual herb up to 125 cm tall, with stout stem, usually much branched; stem and branches angular, glabrous or in the upper part with crisped hairs. Leaves arranged spirally, simple, without stipules; petiole up to 8 cm long; lamina broadly ovate, rhomboid-ovate or broadly elliptical to lanceolate-oblong, very variable in size, shortly cuneate to attenuate at base, emarginate to obtuse or acute at apex, glabrous or thinly pilose on lower surface of primary venation, green to reddish. Inflorescence an axillary, globose cluster up to 2.5 cm in diameter, the upper clusters sometimes forming a terminal spike, with male and female flowers intermixed; bracts broadly ovate, about as long as tepals, awned. Flowers unisexual, subsessile, with 3 tepals up to 5 mm long, having a long awn; male flowers with 3 stamens; female flowers with superior, 1-celled ovary crowned by 3 stigmas. Fruit an ovoid-urceolate capsule up to 3

mm long, with a short beak below the stigmas, circumscissile, obscurely wrinkled, 1-seeded. Seed 1–1.5 mm long, shining black or brown, faintly reticulate.

***Amaranthus spinosus* L. (Uray)** – *Amaranthus spinosus* originates probably from lowland tropical South and Central America and was introduced into other warmer parts of the world from about 1700 AD onwards. At present it occurs in all tropical and subtropical regions, including tropical Africa, often gregariously and as a weed. It is sometimes found in temperate zones as well. It is rarely cultivated. It is a stout, erect, smooth, branched herb, 0.4 to 1 meter high. Stems are armed with slender, axillary spines. (The presence of spines differentiate it from *kulitis* (*Amaranthus viridis*)). Leaves are glabrous, long-petioled, oblong to oblong ovate, or elliptic-lanceolate, 4 to 10 centimeters long, obtuse, alternate. It has a reddish color on the undersurface of the cotyledons and on the stem.

Flowers are very numerous, stalkless, green or greenish-white, about one (1) millimeter long, and borne in dense, axillary clusters and in elongated terminal axillary spikes. Sepals are 5 or 1-3, ovate to linear, often aristate. Petals are scarious. Bracts are linear, bristle-pointed and as long as the sepals or longer. Fruits are utricles, wrinkled, nearly as long as the sepals. Seeds are minute, black and shining.



Cultivation

Kulitis adapts well under lowland condition at temperatures above 25 degrees centigrade and night temperatures not lower than 15 degrees centigrade. It is a short-day plant that consumes a large amount of water and thrives well in areas with six mm/day rainfall. It prefers fertile, well-drained soil with a loose structure.

Propagation

Kulitis is propagated by seeds. Flowering may start four to eight weeks after sowing. The seeds mature after three to four months and are sources of planting materials. However, *A. dubius* will continue its generative stage for a much longer period and when cut regularly, the plant may become shrubby and perennial. At its mature stage, the leaves are succulent and suitable for consumption.

Planting

Kulitis is planted by either direct seeding or transplanting. The choice of planting method depends on availability of seed and labor, and may also vary with growing season. Direct seeding is appropriate when there are abundant seeds, labor is limited and watering is less frequent during the dry season. Transplanting is preferred when there is limited amount of seeds, plenty of labor and during the wet season when heavy rains and flooding are most likely to wash out the seeds.

The seeds are sown directly in rows 0.5-1.0 cm deep and 10-20 cm apart. Within the row, the seeds are sown 5cm apart and covered with a layer of compost or rice hull. Broadcasting is done at a seeding rate of 2-5 g/m² (20-50kg/ha). If transplanted, the seed requirement is only 2kg/ha with plant density of 400 plants/m²

Fertilization

Although *kulitis* requires less management and can grow in poor soil, yield increases with the use of fertilizer. A combination of both inorganic and organic fertilizers improves yield and maintain soil fertility. The amount of fertilizer to apply depends on soil fertility, soil type, fertilizer recovery rate and soil organic matter. Suggested fertilizer recommendations are shown in Table 2 at Asian Vegetable Research and Development Center (AVRDC). Fertilizer recommendation

depends on local condition, conduct of soil analysis is highly recommended to determine the available N, P K content of the soil and determine optimal rates of fertilizer to be applied.

Table 2. Recommended fertilizer rates (kg/ha) for *kulitis* production at AVRDC

Nutrient	Pre-plant	Days after sowing/transplanting		
		10	30	30
Compost	10,000			
N	48	30	8	8
P2O5	64	8	8	0
K2O	48	15	8	0

Water Management

Kulitis needs water just after sowing or transplanting to have a good stand. As a rule, the plants should be irrigated if wilting occurs at noontime. During the rainy season, drainage is essential for plant survival and growth. Raised beds, clean furrows and large drainage canals facilitate quick drainage of excess water after heavy rain. A way to gauge soil moisture content is to take a handful of soil from the bottom of a 15-cm deep hole. If the soil holds together when you release your grip, there is sufficient soil moisture; if the soil crumbles, irrigation is necessary. To maintain vigorous plant growth, avoid over-irrigation which may enhance disease development and nutrient leaching. Drip irrigation or micro-sprinkler irrigation can be used in areas with limited water supply. If sprinkler irrigation must be used, avoid doing this in the late evening to prevent diseases.

Weed Management

Kulitis is small-seeded and slow to germinate, therefore, weed control is essential in its early stage. A seedbed free of weed seeds allows the seedlings to get a head start on the weeds and establish a canopy that can shade out emerging weed seedlings. Hand or hoe weeding can be performed as needed.

Crop Protection

Insect pests and diseases must be controlled to ensure good yield and marketable quality. *Kulitis* is susceptible to damage by foliar insects such as leafminers, leafroller caterpillars, cutworms, aphids, flea beetles, and mites.

A. Insects

1. Leafminers (*Liriomyza* spp.)

Leafminers (*Liriomyza* spp.) are small flies, 1.3-1.6 mm in length. The maggot makes long, slender, white mines (tunnels) in leaves. Severely mined leaves may turn yellow and drop. Severely attacked seedlings are stunted and may eventually die. Control measures are necessary when attack is severe, especially on young plants.



Leafminer (*Liriomyza* spp.) damage on leaf

Control: Pick off and destroy infested leaves in small growing areas. Maintain plant health with organic fertilizers and proper watering to allow plants to outgrow and tolerate pest damage. The parasitic wasp *Diglyphus isaea* is a beneficial insect that will kill leafminer larva in the mine. Use yellow sticky traps to catch egg laying adults. Cover soil under infested plants with plastic mulches to prevent larvae from reaching the ground and pupating. Neem oil will break the pests' life-cycle by preventing larva from reaching maturity. Neem oil may also have repellent qualities and



Cutworm (*Agrotis* sp.)
Early instars are about 7-12 mm long. Fully grown caterpillars are 35-50 mm long.

interfere with egg laying activities. Botanical insecticides can be used to knock down adult insects but have little effect on the protected larval stage feeding inside the leaf.

2. Cutworms (*Agrotis* sp.)

Cutworms attack young seedlings. First instars are 7-12 mm, fully grown caterpillars are 3.5-5 cm long. The caterpillar emerges from the soil at night, encircles the plant with its body and cut through the stem of young plants just above ground level. They may also damage the plants underground. Cutworm damage causes plants to wilt and die. Cutworm

damage is usually minor and does

not normally warrant control. However, in severe outbreaks a young crop may be destroyed.

Control: Monitor damage by counting damaged and freshly cut young plants. Monitor cutworm at dawn. Remove and destroy cutworms. Prepare field and remove weeds well ahead (10-14 days) of planting the crop in the field. Ploughing exposes caterpillars to predators and to desiccation by the sun. If the field is planted soon after land preparation, some cutworms may be alive and attack the new crop.

3. Aphids (*Aphis* spp.)

Aphids are a major pest, causing leaves to curl and become unattractive to customers.

Aphids feed by sucking plant sap. Small aphid populations may be relatively harmless, but heavily infested plants usually have wrinkled leaves, stunted growth and deformed seeds. Plants, in particular young plants, may dry out and die under heavy aphid attack. Heavy attack on older plants may cause crop loss by decreasing flower and seed production. Damage may also reduce seed viability.

Control: Monitor regularly the crop. Whenever necessary spray only affected plants (spot spraying). Use biopesticides that are not harmful to natural enemies (for instance neem, ashes, soapy water). Use neem and water extracts as foliar sprays. Conserve and use natural enemies such as parasitic wasp *Diglyphus isaea*.

4. Spider mites (*Tetranychus* spp., *Mononychellus* spp., *Oligonychus* spp.)



Two-spotted spider mite (*Tetranychus urticae*)
The adult female is 0.6 mm long. The male is smaller.

Spider mites feeding on plants may cause reduction in plant growth, flowering, and number of seeds. Damage is most severe when mites attack young plants. Mite damage may be particularly severe during the dry season.

Control: Avoid planting next to infested fields. Avoid frequent use of broad-spectrum pesticides, in particular pyrethroids; this may lead to spider mite outbreaks. Use overhead irrigation or wash plants with a strong jet of water to knock off mites and destroy their webs. Be sure to spray the underneath of the leaves. However, this should be done early in the day to allow the foliage to

dry. Wetness of the foliage for an extended period is conducive to development of fungal diseases.



Aphids (*Myzus persicae*)
Adult wingless females are oval-bodied, 1-2 mm in body length, of very variable colour.

5. **Pigweed weevil** (*Hypolixus haerens*)

Stem-boring weevils such as the **pigweed weevil** are the most damaging causing plants to wither and lodge. The adult weevil lays its eggs in branch crotches, and the larvae bore through stems to the root collar hollowing the stems. Feeding by larvae results in stems that are more susceptible to wind breakage, thus increasing crop losses. The larvae pupate in the stem.

Control: Uproot and destroy attacked plants to reduce number of weevils and prevent damage to healthy plants.



Adult weevil in amaranth stem

B. **Diseases**

1. **Damping-off diseases** (*Pythium spp. Rhizoctonia solani*)

The disease is caused by *Pythium aphanidermatum*, *Rhizoctonia solani* and *Aphanomyces sp.* Seeds may rot in the soil before emergence (pre-emergence damping-off) or seedlings may exhibit stem canker above the soil line and/or root necrosis. Affected seedlings eventually wilt (post-emergence damping-off). The disease is favoured by high soil water content and low soil temperatures. Also dense planting without sufficient aeration enhances disease development.

Control: Use disease-free seeds. Avoid over watering and dense planting.

2. **Choanephora rot**

Choanephora rot (also called Choanephora blight) is caused by fungus *Choanephora cucurbitarium*. It causes wet rot of stems and leaves. Affected plant parts have hairy appearance (silk-like threads) consisting of fungal spores. Infection is predisposed by injuries. During rainy season it can cause heavy defoliation. The disease is spread by air currents and infected seeds. Warm, moist conditions favor disease development.

Control: Use resistant varieties where available. Plant certified disease-free seeds. Avoid dense planting to allow sufficient aeration. Practise good field sanitation. Spray copper when the disease is observed

Harvesting

Kulitis is ready for harvest in 20-45 days after planting or sowing depending on variety and plant type. Plants may be harvested once or several times. On-time harvesting is adopted for short maturing and quick growing varieties such as *A. tricolor*. Whole plants are pulled from soil with roots, washed and tied in bundles. With multiple harvests, young leaves and tender shoots are picked at 2-3 weeks intervals. Eventually, the plants begin to flower and develop fewer leaves. Frequent harvesting of leaves and shoots delay the onset of flowering and thus, prolongs the harvest period. Kulitis and other leafy vegetables have large surface-to-volume ratio and lose water rapidly. To reduce water loss, harvesting must be done during the cooler time of day such as early morning or late afternoon.

Post-harvest

Since *kulitis* wilts rapidly, common practice in markets and shops is to sprinkle it with water to keep it fresh. If uprooted, *kulitis* can be kept fresh for some days by putting the roots in water in a basin. *Kulitis* are sold in bunches or by weight.

Other Information

Kulitis is recognized as an easy-to-grow, cheap and very productive crop. It is among the highest yielding leafy vegetable of the tropics with excellent nutritional value. Research should focus on optimization of cultural practices, effective pest control and plant nutrition.

Cost of Production and ROI per hectare

VARIABLE COSTS

Labor (P250/man-day (MD))

Clearing (20 MD)	5,000
Bed preparation (20 MD)	5,000
Manure application (10 MD)	2,500
Sowing (2 MD)	500
Transplanting (20 MD)	5,000
Topdressing (20 MD)	5,000
Spraying (20 MD)	5,000
Weeding (30 MD)	7,500
Irrigation (300 MD)	75,000
Harvesting/sorting (240 MD)	60,000
Miscellaneous (e.g. hauling, repairs, etc.) (10 MD)	2,500
Subtotal	173,000

Materials

Seeds (3 kg)	1,500
Manure (40 sacks)	10,000
Fertilizer	
14 - 14 - 14 (6 bags)	7,500
46 - 0 - 0 (20 bags)	3,000
Pesticides	6,000
Fuel and oil	6,000
Packaging Materials	4,000
Miscellaneous (e.g. pail, gloves, etc.)	4,000
Subtotal	42,000

Interest on Production Loan at 21% per annum

51,368.10

Total (Variable Costs)

266,368.10

FIXED COSTS

Land rental	25,000
Depreciation	
Sprinklers (5 pairs)	2,500
Knapsack sprayer (1 unit)	500
Scythe (5 pieces)	100
Hoe (5 pieces)	500
Shovel (3 pieces)	360
Plastic drum (2 pieces)	650

Total (Fixed Costs)

29,610

TOTAL COSTS

295,978.10

GROSS INCOME

Regular season(80,000 bundles/ha at P10/bundle)	800,000
Offseason (40,000 bundles/ha at P15/bundle)	600,000

Net Income

Regular season	504,021.90
Offseason (40,000 bundles/ha at P12/bundle)	304,021.90

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