ACTA SCIENTIARUM POLONORUM

Acta Sci. Pol. Zootechnica 20(3) 2021, 97–104

www.asp.zut.edu.pl pISSN 1644-0714 eISSN 2300-6145 DOI:10.21005/asp.2021.20.3.13

POPULAR SCIENCE ARTICLE

Received: 15.09.2021
Accepted: 25.09.2021

FARM ANIMAL BREEDING OF GENETIC RESOURCES FOR YOUNG FARMERS IN TAIWAN

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ABSTRACT

The agricultural employed population of the year 2020 in Taiwan were 548,000 persons with 74.1% male and 24.9% female. Only 10.9% of those were young farmers with age of 15 to 34 years old. According to the survey of animal industry in 2020, there were about 10,300 livestock farms and 9,900 poultry farms in Taiwan. For those of producing milk, meat and egg in different sectors, the average annual incomes per farm is more than 20 million Taiwan dollar in dairy cattle farms and broiler chicken farms with number of rearing animals per farm were 210 cows and 27,618 birds, respectively. Farm animal genetic resources of 117 breeds in Taiwan updated to 2021, including 20 native breeds, 43 imported breeds, 39 registered new breeds, and 15 ongoing selection breeds, serve as a gene bank for the study of genetic diversity. In Taiwan experience, mule duck production with two species crossbreeding via artificial insemination of laying duck sired with mixed semen from Muscovy duck, it is an essential application of multiple-sires instrumental breeding. In free range production, females of native chicken and laying duck can be multiple-sire natural mating to ensure a higher fertility rate of ovulated eggs. Application of frozen semen and embryo may perform sire-daughter mating, brother-sister mating, or son-dam mating for increasing genetic homogeneity without inbreeding depression of reproduction performance. Inbreeding quickly brings to the surface any detrimental genes that are in a population. With the facility of paternal DNA test, single-sire breeding can be used with extended semen and intra-uterine insemination to test the allele effect of sire genome on their economic traits of pig, cattle, goat, and poultry breeds in a small-scale farming system. Advanced breeding efforts are undertaken to broaden the genetic base of conserved animals and create new breeds that meet the manifold demands in relation to quality, resilience, and sustainability in small-scale farms.

Key words: livestock, poultry, conservation, selection

Young Farmers in Taiwan

Agricultural employed population of the year 2020 in Taiwan were 548,000 persons with 74.1% male and 24.9% female. Agricultural farmers were only 4.8% of overall employed population in Taiwan as comparison to 3.2% in Japan, 5.3% in Korea, 11.4% in Malaysia, 22.9% in Philippines, 29.5% in Indonesia and 31.4% in Thailand. Taiwan young farmers with age of 15 to 34 years old were less than 10.9% as comparison to 70.1% of farmers with age of 35 to 64 years old and 19.0% of farmers over 65 years old. The focus of young farmer is on access to farming data and how young farmers can use the collected information intelligently. The farming goal is to increase the quality and quantity of the products while optimizing human labor production of system reformed and/or machine advanced farm. Young farmers are more simply run the farm for producing more products with less investment and the same amount of land. Hence, the introduction of animal breeding and digital technology into animal farming is for the use of digital technology to integrate animal production from the farm to the consumer. Digital breeding technologies can provide the conservation of genetic resources with tools and information to make more informed decisions and improve productivity of young farmers. Therefore, Taiwan has recently shifted its focus to the aging problem and labor shortage in agriculture sector to have mid- and long-term strategies for training new generation agricultural workers to use precision farming technology.

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Animal Production in Taiwan

Taiwan features high temperature and humidity under the influence of maritime and subtropical climate. As a result of continuous economic development and improved living standards in recent years, the demand for animal protein in the daily diet of local citizens has increased sharply, making animal husbandry one of the most prominent industries in Taiwan agriculture. Livestock and poultry sanctioned by the government include pig, dairy cattle, beef cattle, buffalo, goat, deer, horse, rabbit, chicken, duck, goose, ostrich, and turkey. Due to high land prices and rising environmental awareness plus animal rights, most local farmers operate on a small to medium scale in rural areas of Central and Southern Taiwan. Coupled with import-dependent feeds and expensive laborers, the local livestock industry operates at a rather high production cost. Fortunately, local livestock farmers are highly diligent on profit analysis, and have advanced feeding and breeding skills. As a result, domestic livestock products such as pork and chicken egg not only meet domestic demand but also supply foreign markets. Recently, government policy priorities have been modified to increase livestock products exportation by balancing production surpluses and increases of farmer incomes.

According to the survey of animal industry in 2020, there were about 10,300 livestock farms and 9,900 poultry farms in Taiwan. For those of producing milk, meat and egg in different sectors, the average annual incomes per farm is more than 20 million Taiwan dollar in dairy cattle farms and broiler chicken farms with number of rearing animals per farm were 210 cows and 27,618 birds, respectively (Table 1). Hence, those of dairy farms and broiler chicken farms use animal performance data to adopt digital farming technology recently under smart agriculture 4.0 program. Consequently, smart farming for dairy farms and broiler chicken farms are applying information and big data technologies for optimizing complex farming systems.

Bio-utilization of Farm Animal Genetic Resources

Farm animal genetic resources of 117 breeds and strains in Taiwan updated to 2021, including 20 native breeds, 43 imported breeds, 39 registered new breeds, and 15 ongoing selection breeds, serve as a gene bank for the study of genetic diversity. Dairy cattle, pig, goat, deer, duck, goose and chicken with birth recording, pedigree registration, trait performance records and genotyping information have been promoted to export southeast Asia due to stocks having genes for adaptation to hot and high humidity weather. Mankind started to create breeds of farm animal accompanied with artificial breeding and performance selection 260 years ago. Nowadays, the breeding program can be conducted by small scale farmers for their local breeds. Basically, a phenotype measurement of individual animal in the production farm is essential to evaluate the interaction of genetic and environment as if the breeding stocks were imported recently. Any breeding population begins from one male and one female with natural or instrumental mating. The reproductive life of each female is affected by certain limited factors, such as the puberty age, seasonal breeding, semen quality and fertility to term. So, New breeds and lines by crossbreeding with pedigree are the promotion way of utilization from conservation farms of local genetic resources. Further marketing of local breeds is aimed to keep their genetic abilities for production traits related to social, cultural, food utilization and other purposes of animal keepers.

For the purposes of managing farm animal genetic resources in Taiwan, animal breeders shall carry out pedigree register with the central competent authority for the registered breed or strain described in Article 12 of the Animal Industry Act (enforced from 24 June 1998) if it is so designated by the same authority. The competent authority may dispatch inspector to examine or test the breeding flock, breeding stock, facilities, pedigree registry and related records of breeders, and the breeders shall not evade, interfere with or object to such examination or testing. Breeding flock or breeding stock found to have contracted notifiable disease or have hereditary disease during the aforesaid examination or testing shall be banned from breeding. Breeding flock or breeding stock having hereditary disease, which might be harmful to human health as deemed by the competent authority, shall be destroyed by an agency designated by the central competent authority. The central competent authority shall also compensate the owner of the flock or breeding stock destroyed; the amount of compensation shall be assessed by a body comprised of representatives from government agencies concerned, industrial organizations, experts, and scholars under the invitation of the central competent authority.

The term “genetic modification (GM)” shall mean the transferring of genetic materials or implant of live cells or organisms via genetic engineering, molecular biotechnology, or other related technologies to produce genetic recombination, exogenous genetic characteristics, or to suppress certain genes of the recipient. However, this does not include traditional breeding methods or techniques such as the merging, hybridization, mutation, in-vitro fertilization, somaclonal variation, and chromosome doubling of plants of the same species and protoplasts. The Act has amendment to Article 12–1 dated on 30 January 2002 to require the breeding flock or breeding stock involving the transfer of genetic material shall undergo field tests and creatures safety assessment before it can be promoted and made use of. The transgenic breed-

Table 1. Numbers of farms and rearing animals of Taiwan livestock sectors in 2020

Livestock Sector	Number of Farms (A)	Number of Rearing Animals on Farm (B)	Animal Products	Annual Value of Products (xMillion TWD) (C)	Annual Incomes per Farm (x10,000 TWD) (C/A)	Number of Animals per Farm (B/A)
Dairy Cattle	562	117,874	Milk	11,302	2,011	210
Beef Cattle	793	34,540	Meat	2,464	310	44
Dairy Goat	224	39,965	Milk	485	216	178
Meat Goat	1,654	98,180	Meat	952	57	59
Deer	554	17,321	Velvet	690	124	31
Pig	6,609	5,499,413	Meat	70,944	1,073	832
Broiler Chicken	933	25,776,917	Meat	20,766	2,225	27,628
Native Chicken	3,044	25,889,896	Meat	19,281	633	8,505
Layer Chicken	1,979	42,829,195	Egg	22,010	1,112	21,642

Note: 30 TWD = 1 USD = 3.93 PLN

ing stock and fowl that is used for experiments and study by a research institute is not subject to this restriction.

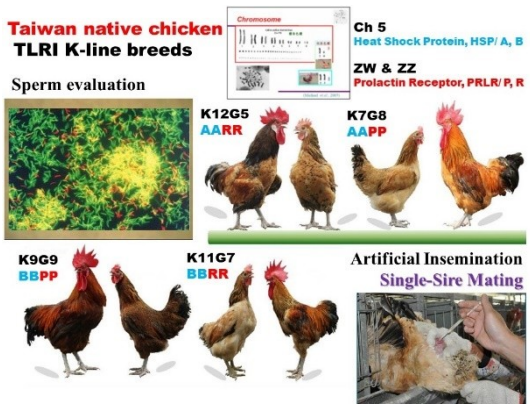
Direction for Screening Application for Letter of Approval for the Exportation and Importation of Breeding Livestock and Poultry and Genetic Resources was promulgated on 26 January 2005 for establishing a safe level of new GM animals in animal production. The central competent authority may commission research institutes or private organizations to engage in collection, appraisal, preservation, and research for the purpose of preserving breeding flock resources and improving the performance of livestock or poultry. Genetic materials of the GM breeding flock, such as semen, ovum, egg, embryo, genes, or genetically modified organisms or transplanted embryo were also regulated by the same Direction for letter approval to export or import. Nowadays, no GM farm animal breeds received letter approval for marketing in Taiwan.

New Breeds from Single-sire and Multiple-sire Mating

In animal species kept for conservation purposes control over the breeding program by the animal keeper and owner is very loose due to limitations of all females in a small scale or lack of frozen semen storage from the breeding sires. The breeding goal, accuracy in collecting phenotypes, genotypes and pedigree registration, selection and mating are all important human factors that should be linked to social activity and marketing potential. The production of regional products with a high additive value and the maintenance of cultural historic activities are not key factors for their amelioration of underutilized animal resources as the developed technique on semen collection and insemination are implemented to the animal keeper. Single-sire breeding is performed to have genetically superior population. Multiple-sire breeding in mixed semen is to increase the fertility rate of female for more female progeny production and to quickly evaluate the favorable gene introgression.

With the facility of paternal DNA test, single-sire breeding can be used with extended semen and intrauterine insemination to test the allele effect of sire genome on their economic traits of goat, beef cattle, pig, and poultry breeds in a small-scale farming system (Table 2). The developed technique on sperm collection, storage, mixing, and artificial insemination allows for a closed population breeding project yearly within a herd, or various populations, and/or various breeds, especially inter-genus crossing. Therefore, maternal, and paternal genotypes of every animal could be unambiguously assigned by Mendelian inference. The siring males were assigned to ensure fertility in the semen mix with low and high sperm quality measurements or based on the genotypic difference from those of sires. The technique overcomes the single-sire problems resulting from lack of rigorous mating control in breeding season under natural conditions or pen-grouping mating of multiple males in a large herd. The ability to pool and deliberately mix semen from many sires and then use this mixture for instrumental insemination of larger groups of dams is a valuable tool for breeding of poultry populations. In commercial production of two species cross mule duck via artificial insemination of laying duck sired with mixed semen from Muscovy duck, it is an essential application of multiple-sires instrumental breeding. In free range production, females of native chicken and laying duck can be multiple-sire natural mating to ensure a higher fertility rate of ovulated eggs. In Taiwan experience, females of native chicken can be selected with multiple-sire natural mating or single-sire artificial insemination to make new lines in the native chicken farm (Fig. 1).

A



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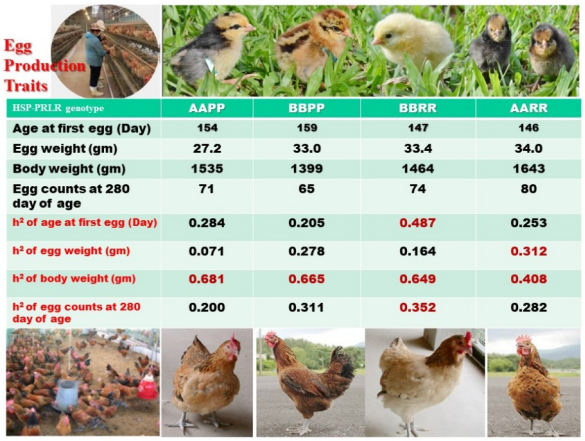

HSP-PRLR genotype	AAPP	BBPP	BBRR	AARR
Age at first egg (Day)	154	159	147	146
Egg weight (gm)	27.2	33.0	33.4	34.0
Body weight (gm)	1535	1399	1464	1643
Egg counts at 280 day of age	71	65	74	80
h^2 of age at first egg (Day)	0.284	0.205	0.487	0.253
h^2 of egg weight (gm)	0.071	0.278	0.164	0.312
h^2 of body weight (gm)	0.681	0.665	0.649	0.408
h^2 of egg counts at 280 day of age	0.200	0.311	0.352	0.282

Fig. 1. An example of precision recording on egg production traits of native chicken in Taiwan: (A) Four lines with genetic markers and feather phenotypes; (B) Egg production traits of four lines

New Breeds from Inbreeding and Outbreeding

Inbreeding increases homozygosity and decreases genetic diversity. Although frozen semen is commercially available in dairy cattle mating system, but there are not for all of livestock breeds, especially in local breeds. Application of frozen semen and embryo may perform sire-daughter mating, brother-sister mating, or son-dam mating for increasing genetic homogeneity without inbreeding depression of reproduction performance. Inbreeding quickly brings to the surface any detrimental genes that are in a population. Some excellent inbred lines of goat, pig, chicken, goose, and duck were developed with selection for growth and good reproduction (Table 2). A very large proportion of the inbred animals will have that first champion male as ancestor after several generations. Large genetic contributions of genetically superior animals will spread through the population and remain there as excellent inbred lines.

As the example of native pig in Taiwan, the economic value of annual native and/or black pig production shares about 12% of total value of pork products in 2020 from small scale farms. Native Taoyuan breed of solid black coat color was the major breed before 1900, then the Berkshire from Japan was introduced into the blood of black pig breeds during the period of 1910 to 1945. Occidental Yorkshire, Landrace and Duroc breeds were evaluated by national research institutes during 1963 to 1972 to promote the LYD three-way crossbred hog production in commercial farms. Thereafter, Taoyuan breed was still used in small scale farmers as the maternal line and then was sired by Duroc boar with the dark red coat color and black toe to produce piglets of solid black coat color and black toe. Those of black pigs in small scale farms were varied with paternal bloods from Large Black breed of UK, Hampshire and Berkshire breeds of USA, and Meishan breed of Japan. In commercial black pig herds, most of hogs were raised to a heavy size of 125 150kg of live weight at slaughter with more than 8 months old. In Taiwan, native miniature Lanyu breed was developed into inbred lines for biomedical application since 1990 although it was the major breed in the roast pig market with 15 30kg of live weight in 5 7 months old. The breeding and supply system of native and/or black pig breeds have been carried out to achieve goals on birth recording, growth performance test and genotyping of meat quality.

Crossbreeding is mating between animals of different breeds. Outbreeding is mating between animals of different lines within a breed. Phenotypic heterosis or hybrid vigor is the extent to which the performance of a crossbred in one or more traits is better than the average performance of the two parents. Heterosis is often substantial for fertility and health characteristics that cannot be easily improved by selective breeding due to the low heritability. Dominance is the genotypic value of the heterozygote on a trait is not the average of the two homozygotes. Alleles with a negative effect are often recessive. Two breeds are crossed and the offspring is used only for milk, egg and meat production purposes and is not used for selection breeding.

Gene introgression is to cross males of breed B with females of breed A to incorporate a characteristic that is present in breed B with a high frequency and that is absent or has a low frequency in breed A. For those underutilized animal resources, they may absent or has a low frequency of one allele that resulted in higher quality in disease resilience and heat-tolerant reproduction. Application of introgression way is performed from local herd to imported herd for having the traits of local herd.

Grading-up is the method used aims to change a population of animals quickly from one breed to another.

Table 2. New Breeds Registered in Taiwan from 2000 to 2020

New Livestock Breeds: 15				New Poultry Breeds: 19			
Breed Name	Reg. Year	Breed Name	Reg. Year	Breed Name	Reg. Year	Breed Name	Reg. Year
Kenting Goat	2015	Lee-Sung Miniature Pig	2015	Black Velvet Silkie Chicken	2020	Better Feed Efficiency Brown Tsaiya Duck	2018
Hengchun Line of Taiwan Black Goat	2014	White Binlang Pig (Lanyu 400)	2011	Fenghui Hsiaying Red-Brand Country Chicken	2018	Wujie White Duck	2015
Hualien Line of Taiwan Black Goat	2014	KHAPS Black Pig	2009	LRI White Silky Chicken	2014	Beidou Brown Goose LRI-1	2014
Ji-An Goat	2014	Lanyu Pig GCP Line (Lanyu 300)	2008	TLRI K7 Chicken	2014	Beidou White Goose LRI-2	2013
Taiwan Yellow Cattle	2010	Lanyu Pig (Lanyu 200)	2008	TLRI K9 Chicken	2014	Wujie Black Muscovy	2013
Taiwan Swamp Buffalo	2010	Taoyuan Pig 200	2008	TLRI K11 Chicken	2014	Beidou White Goose LRI-1	2009
		Mitsai Pig (Lanyu 50)	2003	TLRI K12 Chicken	2014	Brown Tsaiya LRI-3 Duck	2008
		Lanyu Spotty Pig (Lanyu 100)	2003	Kaishing Guiding Native Chicken	2014	White Muscovy LRI-1	2007
		TLRI Black Pig	2000	NCHU Native Chicken Line101	2012	Brown Tsaiya LRI-1 Duck	2005
						Brown Tsaiya LRI-2 Duck	2004

- Animal Industry Act of Taiwan: Article 12-2 New breed or new strain of breeding flock or breeding stock incubated or discovered by an employee should be registered with the name of the employer unless it is otherwise specified in the contract.
- Applicants who apply for registration of breeding stock and fowl or genetic resource in accordance with Article 12 of the Act should fill out application forms and submit the following documents:
  1. the certificate of the company, agency (institution) or farm
  2. the description of the process of incubation or discovery
  3. the rearing experiment report
  4. the physical object, product, or its photo
  5. other documents designated by the central competent authorities

Imported Sires or frozen semen of the newly desired breed are continually backcrossed to the females from the previous generation. After three generations the F3 animals contain already for 87.5% the genes of the desired breed and after four or five generations the population fully resembles the desired parental breed.

New breed or synthetic breed is from that two breeds are crossed and males and females of the F1 generation are reciprocally mated to create a breed containing equal parts (50%) of the alleles of the two founder breeds. According to this principle also three or four breeds can be used to create a synthetic breed as a new breed.

Age at First Calving and Milk Quality of Dairy Cattle

The lifetime productivity of a cow is influenced by age at puberty, age at first calving and calving interval. One of the major problems on tropical small holder farms is the high calf mortality and the very high ages at first calving of replacement heifers. Ages at first calving vary from 30 to 36 months on most tropical small holder dairy farms, compared the 24-to-30-month targets. Optimum age at first calving for total lifetime performance of dairy cattle was 22.5 to 23.5 months of age. In Taiwan, the Dairy Herd Improvement (DHI) is one of the most important projects for dairy industry since 1978. Under a breeding scheme for heat-tolerance and early mature dairy cattle in tropical Taiwan, age of first calving within 27 months was found in 41% of cows in 2001 and 87% in 2020, reducing first calving age did not have a significantly less fat% and protein% in milk along with less somatic cell counts and a higher daily milk yield. Cows calving in 2001, their age of first calving within 24, 27 or 30 months were found in 14%, 41% or 72% of 4,685 cows, respectively; as calving in 2020, there were found in 32%, 87% or 95% of 6,089 cows. There was a significant increase on percentage of first calving within 24 months in last 20 years.

Milk quality of DHI cows was monitored per month on solid non-fat percentage (SNF%) and somatic cell counts (Fig. 2). There was an increase of milk solid non-fat percentage, and a decrease of somatic cell counts after adjusted milk yield from 2000 to 2020. This data analysis presented that the improvement of dairy herd farming was resulted from the impact of precision recording of cow performance with the major seasonal effect, especially due to summer heat stress. Thereafter, a good farming

with precision recording will result in a higher production efficiency and value-added quality. The essence of digital farming lies in creating value from farming data. Significant advances in genetics, milking machines, nutrition, and farm management have combined to create the dairy industry we know today in Japan, EU, and USA. For example, the annual milk production per cow in USA has tripled from 2,404 kg in 1953 to 9,049 kg in 2007.

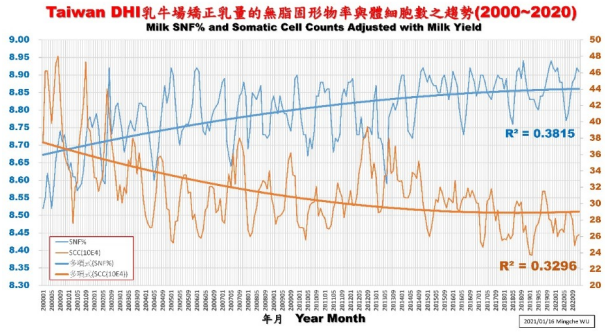

Fig. 2. Trends and seasonal variations of cow milk quality (solid non-fat percentage and somatic cell counts adjusted with milk yield) from 2000 to 2020 in Taiwan dairy herd improvement (DHI) farms

In tropical Taiwan, the annual milk production per cow has improved from 5,308 kg in 1981 to 8,343 kg in 2020 by importation of frozen semen, alfalfa hay and management machinery from Europe and North America. Far-east Asian dairy cattle improvement units of Japan, Korea and Taiwan have been the nation member of ICAR since 2011. No unit of ASEAN is the nation member of ICAR dated in 2021. The standardized DHI data interface is a two-way approach and will enhance value to the dairy farmer and the providers of on-farm systems in addition to those providers with centralized databases. In Taiwan, Ten Tons Cow is designated as milk yield of 305–2X-ME greater than 10,000 kg for hot and humid environment. Dairy cows with trait performance records and genotyping information in Taiwan DHI program have been promoted to improve production efficiency of dairy farms and to have next generation heifers from Ten Tons Cows, which had genes for adaptation to hot and high humidity weather. For breeding scheme of dairy cattle, selection on milk yield and quality associated with reproductive performance is essential to the hot and humid weather, and therefore selected cows will become a heat-tolerance line for Southeast Asia.

Genomic Selection in Breeding Farm

Molecular information of genetic marker assisted selection (MAS) can increase the selection accuracy of economical traits and subsequently the selection response in animal breeding programs. From dairy cattle to pig, the rates of genetic improvement could increase from 30 to 70 % and production traits can be improved more effectively. In Taiwan, applications of animal genomics research and quantitative genetics are used to accelerate genetic marker assisted selection for economic traits of food animal with favorable genes. Clearly, low-cost diagnostics based on MAS information will be the next wave of development for livestock and poultry farming in farmer scale. Genomic breeding stocks based on its high economic value in industry sector are registered at www.angrin.tlri.gov.tw web site with their pedigree and life barcode. The successful breeding program via genomic information mainly depends on the quantity of DNA information, accurate and reliable recording system, and the integrating efficiency between both. Taiwan Animal Germplasm Center (TAGC) of Taiwan Livestock Research Institute has automatic experimental equipment to screen effectively the harmful genetic factors and productive transgenes for the breeding stocks in food animal industry. Genetic certificate workflow has been established for genetic markers of breeding pig, dairy cattle semen, meaty goat, heavy antler velvet deer, prolific egg and meaty chicken, and prolific egg duck and meat mule duck.

Digital Auction of Breeding Boars

Auction on purebred pig stocks at national level has been conducted after growth performance test of piglets and body conformation contest of pubertal pigs in Taiwan since 1975. DNA test of Hal-1843 halothane stress gene on chromosome 6 has been applied with MS-PCR method for PSS-gene free of breeding lines to reduce hog mortalities and improve meat quality without PSE in commercial herds in Taiwan since 1990. In 2002, both estrogen receptor gene (ESR) on chromosome 1 for litter size and heart fatty acid binding protein gene (H-FABP) on chromosome 6 for meat quality have been applied on boars in the growth performance test stations. Duroc, Landrace and Yorkshire boars had average daily gain greater than 1.056, 1.128 and 1.065 kg per day from 40 to 110 kg of body weight, respectively. Feed efficiency in the ratio of feed uptake to weight gain from 40 to 110 kg was less than 2.038, 2.037 and 2.055 in Duroc, Landrace and Yorkshire boars. A total of 21 traits of purebred pigs were measured from coat color since 1971 to genotypes since 1990 (Fig. 3).

Body conformation contest of pubertal pigs since 1978, boars must be the age of 240 to 300 days old, and gilts are 200 to 250 days old. The body weight limits are 150 to 185 Kg in boars and 110 to 160 Kg in gilts. Prior to contest, DNA test of porcine stress syndrome-gene free on all pigs since 1996 and semen quality measurement of

boars have been tested since 2005. On the auction date, three judges will look individual pig in each single pen in the retaining house and 2/3 portion of pigs by breed and gender are then pre-selected. Those of pre-selected pigs are then come to stage by group in gilt and by individual in boar for top 1/3 ranking on score of body conformation.

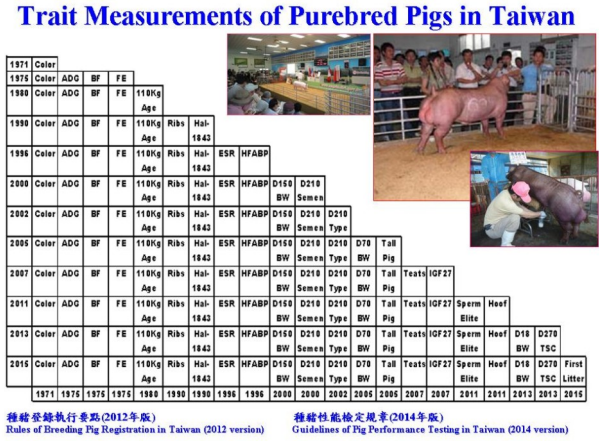

Fig. 3. Trait measurements of purebred pigs since 1971 in Taiwan

Champion boars of Landrace, Yorkshire, and Duroc breed are then displayed at show pens side by the stage. Excellent hoof evaluation on those of top 1/3 ranked pigs will be further judged by another three experts to rank the top 1/3. Hence, the buyer will have all performance and phenotype information of each pig before the auction take place (Fig. 4). Final auction price of each pig will be displayed in the sold listing on the screen and on the web. During the auction, a web-linked screen via Facebook or YouTube can be viewed by second-delayed mode for the public. A film with 30 to 60 seconds for each auction pig will be posted on the web for the public three days after the auction and such multimedia data will serve as post-auction information for pig buyer and original breeder to estimate the locomotion value of each auctioned boar. Champion awarding activity to those of breeders having pigs with top one rank on growth index, body conformation and excellent hoof in each contest also will be recorded and linked in a web page to honor the achievement of pig breeder and to express the involvement of concerned organizations. Occasionally, visitors from aboard or policy makers will make a brief remark to the auction activity or sharing the visiting reasons before awarding. The judge and/or honorable guest will present the champion plate to the breeder from growth index, followed by the body conformation, and last on hoof.

A

B

Fig. 4. An example of digital farming on breeding boars combined with auction activity and web-based data in Taiwan: (A) Breeding boar on auction stage with web-based data; (B) Champion plate to the breeder farm on growth performance index and body conformation contest by breed of Landrace, Yorkshire and Duroc

Potential and Challenges Coping with Climate

Farm animal genetic resources play a crucial role in cultural and social-based activities. They hold the key to diverse and healthy diets and to the adaptation of animals to a changing and more variable climate. This potential can be sufficiently used by young farmers with current farming modes for local markets, even can be served as genetic materials to develop new breeds with modern technology. Furthermore, advanced breeding efforts are undertaken to broaden the genetic base of conserved animals and create new breeds that meet the manifold demands in relation to quality, resilience, and sustainability in small-scale farms.

Wu, M. (2021). Farm animal breeding of genetic resources for young farmers in Taiwan. Acta Sci. Pol. Zootechnica, 20(3), 97–104.
DOI: 10.21005/asp.2021.20.3.13

HODOWLA ZWIERZĄT GOSPODARSKICH Z ZASOBÓW GENETYCZNYCH DLA MŁODYCH ROLNIKÓW NA TAJWANIE

STRESZCZENIE

Populacja zatrudnionych w rolnictwie w roku 2020 na Tajwanie wynosiła 548 000 osób, z czego 74,1% stanowili mężczyźni, a 24,9% kobiety. Tylko 10,9% z nich stanowili młodzi rolnicy w wieku od 15 do 34 lat. Według badania ankietowego w przemyśle hodowlanym w 2020 r., na Tajwanie było około 10 300 gospodarstw hodowli zwierząt i 9 900 gospodarstw drobiarskich. Dla gospodarstw specjalizujących się w produkcji mleka, mięsa i jaj w różnych sektorach, średni roczny dochód na gospodarstwo wynosi ponad 20 milionów dolarów tajwańskich. Pogłowie w gospodarstwach bydła mlecznego i fermach brojlerów wynosi średnio na gospodarstwo odpowiednio 210 krów i 27.618 brojlerów. Zasoby genetyczne zwierząt gospodarskich 117 ras na Tajwanie zaktualizowane do 2021 r., w tym 20 ras rodzimych, 43 ras importowanych, 39 zarejestrowanych nowych ras i 15 bieżących ras selekcyjnych, służą jako bank genów do badania różnorodności genetycznej. W doświadczeniach tajwańskich, produkcja kaczek z krzyżowaniem dwóch gatunków poprzez sztuczne unasienianie niosek mieszanym nasieniem kaczki piżmowej, jest niezbędnym zastosowaniem wielorasowej hodowli instrumentalnej. W chowie wolnowybiegowym samice kur rodzimych i kaczek nieśnych mogą być kojarzone w sposób naturalny wielorasowy w celu zapewnienia wyższej płodności jaj owulowanych. Zastosowanie mrożonego nasienia i mrożonych zarodków może prowadzić kojarzenie reproduktor-córka, brat-siostra lub syn-dam w celu zwiększenia homogeniczności genetycznej bez depresji chowu wsobnego w zakresie wydajności reprodukcyjnej. Chów wsobny szybko wydobywa na powierzchnię wszelkie szkodliwe geny, które są w populacji. Dzięki możliwości badania ojcowskiego DNA, hodowla pojedynczych reproduktorów może być stosowana z rozszerzonym nasieniem i inseminacją domaciczną w celu zbadania wpływu alleli genomu reproduktora na ich cechy ekonomiczne ras świń, bydła, kóz i drobiu w systemie hodowli na małą skalę. Zaawansowane prace hodowlane są podejmowane w celu poszerzenia bazy genetycznej zachowanych zwierząt i stworzenia nowych ras, które spełniają różnorodne wymagania w odniesieniu do jakości, odporności i zrównoważonego rozwoju w gospodarstwach małoskalowych.

Słowa kluczowe: zwierzęta gospodarskie, drób, ochrona, selekcja

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