ARTIFICIAL BREEDING OF LARGE RUMINANT PRODUCTION : BASED ON EXPERIENCES IN THAILAND

Maneewan Kamonpatana*

Abstract

Maneewan Kamonpatana*

ARTIFICIAL BREEDING OF LARGE RUMINANT PRODUCTION : BASED ON EXPERIENCES IN THAILAND

The author has been much concentrating on biological regulation for enhancing fertility and growth with co-incidentally better health care. The three aspects of achievement of fertility, growth and health within one injection may be called "Three in One that is Mato-Matid technology". However, Mato-Matid technology did provide a great deal of prime biological responses positively to several reproductive technologies in which some of them may be regarded as artificial breeding like IVM/IVF/IVC/ET/Cloning.

Key words : Ruminant, Mato-Matid technology

*** Research Centre for Bioscience in Animal Production, Faculty of Veterinary Science, Chulalongkorn University, Bangkok 10330, Thailand**

Large ruminants in tropical environment, they are buffaloes and cattle. In Thailand, as an area of hot climate and high humidity, the animals were subjected to adapt themselves not only temperature but even more harder in adaptation to humidity. Environment interaction among the nutrition plants and biological responses on temperature and humidity contributed greatly to depress the genetic expression. Production of large ruminant is, therefore, in tropical environment mainly focussed on reproduction and health care. Natural selection was resulted in well performance but low reproductive rate. According to author's career as a chemist and biochemist. I have been much concentrating on biological regulation for enhancing fertility and growth with co-incidentally better health care. The three aspects of achievement of fertility, growth and health within one injection may be called "Three in One that is Mato-Matid technology." However, Mato-Matid technology did provide a great deal of prime biological responses positively to several reproductive technologies in which some of them may be regarded as artificial breeding like IVM/IVF/IVC/ET/Cloning.

Reproductive technologies in farm animals that created in Thailand during the 30 years of author's career may be summarized as follows :-

1) Early Pregnancy Diagnosis (EPD): EPD using progesterone (P_4) test to detect non pregnant animals in cattle and buffaloes was well established in milk and plasma determination. The P_4 test was simplified as a kit test which is available for farm testing.

2) Mato-Matid Technology : The technology was illustrated as a hardware using active immunization against anabolic substances and as a software conceptualizing the optimum condition of man, animal and plant to live together for reproducing the clean products, low cost and selfsupporting.

3) Artificial Breeding : Artificial breeding before implantation was generally described in the world . The consequential steps in laboratory were described in terms of; *in vitro* maturation (IVM), *in vitro* fertilization (IVF) and *in vitro* culture (IVC) then the grading embryos were transferred to the recipients. The recent development of cloning from somatic cells in mammal was a breakthrough of science technology in bringing out the artificial breeding for mass reproduction.

Altogether the said three reproductive technologies were established by the author in tropical condition of the developing country liked Thailand. Almost the techniques in these technologies were published and disseminated throughout the world by regular training and bilateral technical assistance.

The important advances in artificial breeding and the control of buffalo and cattle reproduction have been made during the last three decades (1971-2000) in Thailand under the author's direction. The first decade (1971-1980) was emphasized on improving the efficiency of artificial insemination using progesterone (P_4) test. Methodology of developing P_4 test in plasma for buffalo and in milk for dairy cattle was intensively established. P_4 test has been operated as a routine for early pregnancy diagnosis in farm level as well as disseminated to participants from many countries all over the world.

The second decade (1981-1990), there was a need to solve the problems of subfertility, the delay of ovarian resumption and the incidence of endometritis. The on going activity of endocrine regulation was turned key to use active immunization against testosterone that enable to develop "Matid" an agent to overcome the said problems. In order to increase the productivity of young breeders, the young stocks were improved by enhancing the calf growth rate both in buffalo and cattle, using an agent called "Mato"; an active immunization against preg-

nenolone. It is, therefore, Mato-Matid technology has been established since then.

CLONING

The artificial breeding on IVM/IVF/IVC and ET was systematically developed since last two decades (1981-2000). It was a unique stepwise to up the laboratory in associated with training the personnel and also providing the routine services on farm level. For the third decade (1991-2000), the success of embryo transfer in dairy herds and *in vitro* embryo production in cattle, buffalo and pig was ready to establish as a regular programme. It was capable to be topped up by cloning in the year 1998.

Historic record of Thailand in artificial breeding, the twining female calves, whom born by embryos from two donor cows and transferred to one recipient in 1986 named "Jum" and "Jim", was a historic achievement of Thailand in ET. Recently in the year 2000 on the 6th of March, the first cloning female calf named "Ing" in twining with an AI male calf named "Oun" were born from a recipient dairy cow named "Oil" was also becoming a historic achievement of Thailand, a brief information was recorded as follows.

The success of first cloning female calf "Ing" was reproduced from the fusion of somatic cells "ear cell" of a donor heifer Brangus (Brahman x Angus) aged 13 months old with the denucleated mature oocyte collected from slaughter house. The cloning blastocyst of 7 days was transferred to a Holstein Friesian receipt that already inseminated 7 days before. She was under the Matid programme to enhance fertility and delivered the twining calves of Ing (female cloning) and Oun (male AI).

Cloning of buffaloes and pig are in progress. Several somatic cell types were introduced to the programme. The appropriated artificial breeding has been assessed and providing to animals belonging to the farmers, it was the dynamic arrangement that enable the new technology to be seen and accepted directly by the users.

ECONOMIC OPTIMIZATION OF REPRODUCTIVE PERFORMANCE

Reproductive Performance of a dairy herd affects **profitability** of the farm. Reproductive inefficiency reduces milk yield and numbers of calves born, replacements production and may increase the cost of veterinary services, it also affects the culling rate.

Insemination, treatment, and culling decisions represent the dynamic of dairy herd management that ultimate affecting **profitability**.

To make rational decisions, the farmer needs a valid estimation of the future profitability of each cow, accounting for factors including age, production level, lactation stage, pregnancy status and disease history.

Reproductive Management Programme (RMP) can be used for optimizing a sequence of interrelated decisions. RMP is a dynamic programme that developed for optimizing breeding and replacement decisions in dairy herd; as illustrated in the database of semi manual – computerized programme to monitoring the management of concurrent moving from 5 grouping of the herd as ;

Group 1 Milking cow
- Dry cows
- Post partum cows that waiting for AI

Group 2 Inseminated cows
- waiting for EPD & pregnancy confirmation

Group 3 Confirm pregnancy
- waiting for calving

Group 4 Replacement heifers
- starting from yearling up to first conception

Group 5 Female calves
- raring up to 12 months of age before moving into Group 4

It is necessary to convince the farmers to cooperate and keeping up in collecting data manually then put in computer, RMP was developed gradually then the prediction of 10 years plan ahead was proposed to generate the estimate herd of 100 milking cows and project to 10 years operation. This programme was well accepted by the farmers that operated 50-100 milking cows.

In recent years, the integration of five technologies have been implemented.

Profitability of using integrated technologies of

1. EPD
2. RMP
3. Mato – Matid Tech.
4. ET
5. CMN block

Profitability was shown in comparison with non using of the said five technologies, particular Mato-Matid technology. The farmers realized the adventages of employing the said technologies that evidences by investigation of monthly incomes in the farm.

It is our ultimate goal to monitoring RMP under tropical condition to increase the percentage of shorter calving interval.

The ideal calving interval of 12 months can be obtained only the optimal replacement was operated in the farms.

OPTIMAL REPLACEMENT AND BREEDING DECISION

There are 5 factors that contributed to breeding decision in order to replace the breeding cows optimumly.

(1) High milk yield cows were necessary to take care of energy balance and they should conceive not later than 90 days post partum.

(2) Genetic merit cows must be assessed for milk yields, lactation periods and numbers of insemination per conception. Sire selection using high pedegree of frozen semen must be planned properly in breeding decision.

(3) Sire selection using high pedegree of frozen semen must be planned properly in breeding decision.

(4) Replacement heifers must be well kept the record of genetic merit, both from dams and sire selection.

(5) Reproductive disorder in the milking cows that retained over year after mediated by Mato-Matid technology should be culled.

RISK FACTORS FOR POOR REPRODUCTIVE PERFORMANCE

Increased Risk of Reproductive Disorder :

Higher milk yields animals usually were kept longer than the lower milk yields animals and receive more veterinary treatment because of their reduction of fertility.

Higher milk yields cows appeared to higher reproductive disorder of

- dystocia
- retained placenta
- metritis
- silent heat
- ovarian cysts

The non used of Mato-Matid herds, these reproduction disorder was around 7-9% of the breedings herds. Based on our experiences, the herds received Mato-Matid to mediate biological responses both in breeders and replacements, these reproductive disorder was less than 1%.

Risk factors for delayed conception :

Numbers of AI per conception may be an index to monitoring of breeding decision, particularly when the animals should be culled. Most farmers have planned their animals to inseminate

at the first heat after calving except the higher milk yield cows may be served during 60-90 days post partum. The higher milk yield animals retained to conceive later than the lower milk yield animals. It is necessary to advise the farmers of the regime in feeding management according to milk production of individual animals. Ratio of feeding quality and quantity must be concurrent followed up to the milk yields in order to balance the energy supplied to the higher milk yield animals.

CONSEQUENCES OF POOR REPRODUCTIVE DISORDERS

Lower milk yield due to reproductive disorders :

It was found that disease, caused milk loss and on the other hand increased milk yield, is associated with other diseases too. How to manage properly by using external regulation, it seems to be not sufficient. Other alternatives may be required. Our suggestion is to combine with Mato-Matid regulation. Mato-Matid did provide the animals to balance internally themselves that resulted in a greater rate of growth, enhancing fertility and a better health care.

Shortened productive life :

Culling is a complex issue : Many factors are involved. Dairy cows are culled for involuntary reasons like; death, acute disease and infertility and some are culled for voluntary reasons like **low yields**, over population in herd management. Culling is a key management of whether economically concerns as immediate term or short term or long term then . It is, therefore, "*culling*" to be a method of choice. Farmers who made the decision, sometime their decision were beyond the technological approach, it was often that they must relied on self-survival in maintaining the farms first before any decision would be made for taking the prevention of advance technologies.

MATO-MATID TECHNOLOGY

The swamp buffaloes of Thailand as well as the other countries in China and Indochina have been in existence for over 6,000 years. Fossilised bones of swamp buffaloes excavated at H8-Mu-Tu, in Yu-yao county, Ningbo City, Zhejiang province were from distinct successive earth's crust strata, the oldest materials being lowest in the sequence. Fossils in the lowest stratum were 9,000 to 10,000 years old : those in the upper stratum were dated at approximately 7,000 years of age. (Chen and Li, 1989). In recent times the swamp buffalo in Thailand is drastically reduced. The problems can be crystallized in to its low reproductivity under traditional rural practices. The female buffaloes have poor ovarian functions due to poor nutrition, this also gives rise to higher rate of abortion and high calf mortality. What's more this low reproductivity is further exacerbated by the lack of mating bulls. The reason for this is in tradition practices the 3-4 years old bulls are castrated making them docile and conducive to rural domestic and farming use.

The challenge during the author early career was how to improve the buffaloes fertility and reduce the rate of calf loss.

Early researches concluded that the abuse of buffaloes under socio-economic depression lead to malnutrition and subfertility of these durable animals.

Tests were initiated to normalise the hormones of the female buffaloes, several compounds of sex steroids conjugated to protein or gelatin were developed as an active immunogen. These conpounds, ranging from Androstenedione, Estradiol, Estrone, Testosterone and DHEA , are injected into the female buffaloes. Finally, testosterone immunogen was found to be suitable. These injections, averaged 1.8-3.2 injections, depending on the state of subfertility that the female buffaloes were needed. The immunogen produced excellent

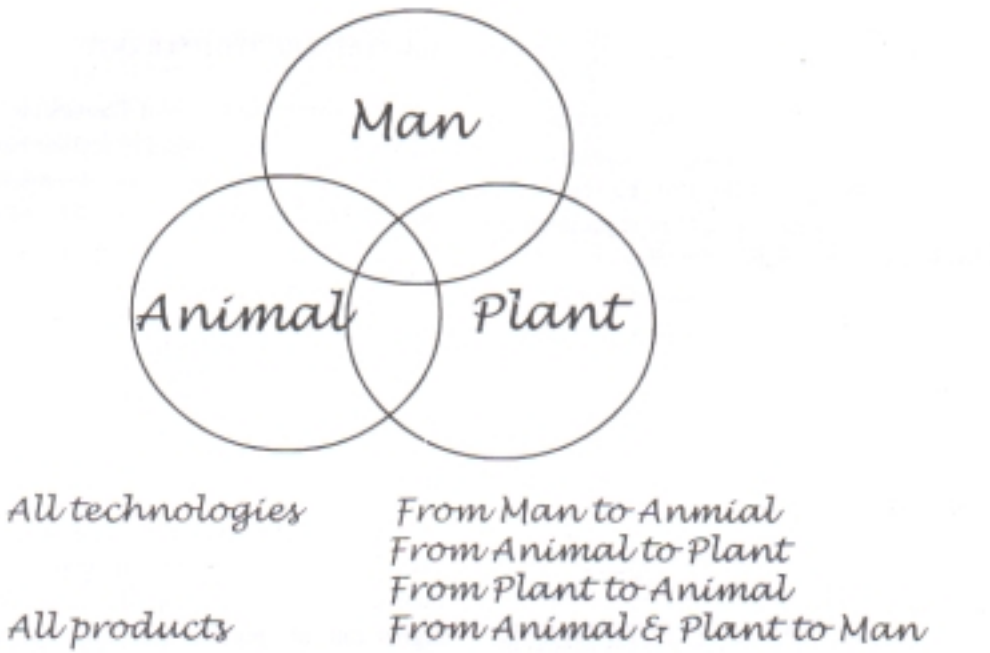

Diagram I Optimal integration of man, animal and plant to keep art of living together in the manner of peaceful life for all.

result increasing the average calving rate from 18-21% to over 70%.

A new immunogen of pregnenolone conjugated with a protein or gelatin called "Mato" (pronounced MATO as in go) was incidentally formed by testing in male buffaloes. The substance was successfully used in both male and female. Those animals that were inoculated become fast growing and fertile and were also resistant to foot and mouth disease.

"Mato-immunogen" produced an excellent result. The bulls' body weight reached the average puberty target in greater quantity than those not injected with this "Mato immunogen"

The term "Mato" is a Thai words meaning "come and be bigger" other words come and get this injection and be bigger. While the term "Matid" (pronounced-MATEED) means "come and be fertile" - come and get this injection and be fertile.

These "Mato-Matid" technology were extended to other farm animals such as cattle, pigs, sheep, goat, duck and chicken with satisfactory results. (see references).

From these 30 years, experiments and observations the author postulated that the interrelationship between man, animal and plants are constantly, coexisting by modulation each others so optimal equation exists. Since the modern society is materialistic with the aim of maximization of economic gains, this equilibrium will be upsetted with the dire consequence to our environment and ultimately to ourselves. The mato-matid technology provide us with the lesson of optimization rather than maximization to re-establish the disequilibrium between man, animal, plant for his animal and for himself and his environment. The optimum technology must have low cost, be a clean product and self supporting or at least sustainable as illustrated in diagram I.

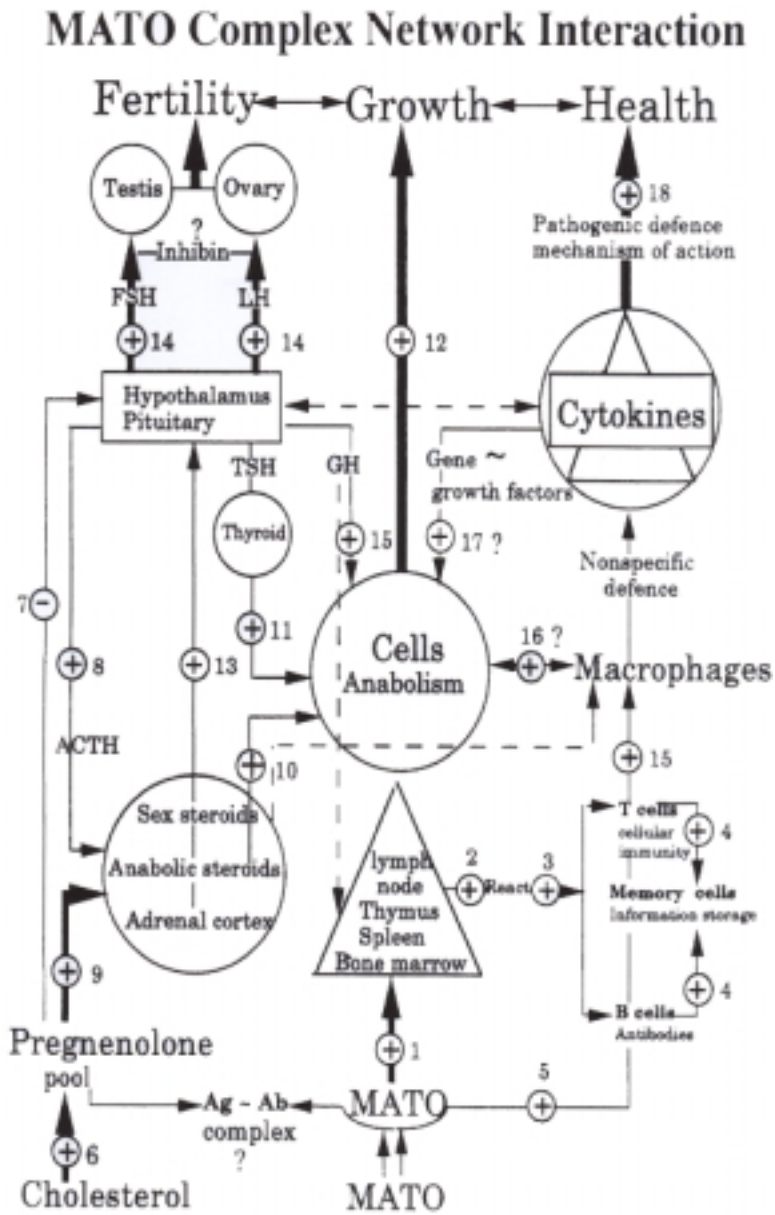

Diagram II Complex Network Interaction of cellular mechanism of action : an effect of MATO triggering on enchancing growth, reproduction and diseases resistance, by cytokine mediated through the whole systematic immune cells (△) endocrine (○) and neuroresponses (□)

Originated from "Discovery of Mato for Enhancing Animal Productivity and Reporductivity" by Professor M. Kamonpatana, from Animal and Plant Technology, Proceedings of the seminar held at Sichuan Agricultural University, Yaan, Sichuan, People's Republic of China during 6-10 May 1996 under the framework of Technical Exchange between Chulalongkorn University (CU) and Sichuan Agricultural University (SAU) during 1993-1996, page 202 (page 199-218).

How Mato-immunogen is working?. It may be postulated that it works as a complex network interaction. Mato is working as a mediator to start the chain of reaction in the whole body with no limited action . A dynamic event was already shown in the magnificent attribute of enhancing growth, improve reproduction and pathogenic resistance when Mato was presented to the body and acting as a trigger to start the immune function. The action of Mato may possible be a chain reaction which gets through the immune system. The cellular mechanism of action of Mato was suggested to take up as a complex network interaction that enable cytokines to bridge the endocrine system through the nervous system thus these system are working dynamically in the anabolic correspondence. It may be proposed that such chain reaction is a powerful mechanism to maintain the vitality and health of the whole body as illustrated in diagram II. On top of this view, the meaning of life may be defined as *"life is an active biological chain reactivities in the body"*.

The author would like to suggest that in nutrient requirement and health care, it may be worthwhile to exploit their uses through the concept of Mato-Matid technology means using vaccination to substitute oral treatment.

Mato-Matid technology consisted of two components as 1) hardware of synthesized immunogens for vaccination and 2) software of lesson to manage the optimal condition; that allowed man, animal and plant to living together in the manner of peaceful life for all.

CONCLUSION OF MODERATE WAY IN ORDER TO ACHIEVE THE PRODUCTIVITY

Low cost

Clean products

Self supporting

1. It is a long term for developing country to get everything in order.

2. Benefit towards profit needed to balance all the time. The success both from humaness and out put of technologies was based on the dynamic management under the integration of man, technical approach and economical acceptance due to time by time.

REFERENCES

Chen, Y.C. and Li, X.H. 1989. New evidence of the origin and domestication of the Chinese swamp buffalo (*Bubalus Bubalis*). Buffalo Journal 5 (1) : 51-55.

Jintana, R., Duangtanan, B., Ngunhom, K. and Kamonpatana, M. 1996. Trend of economical benefit in farms using MATO-MATID and CMN block : An Integrated Technology. Animal and Plant Technology : Proceedings of the seminar held at Sichuan Agricultural University, Yaan, Sichuan, People's Republic of China, during 6-10 May 1996 under the framework of technical exchange between Chulalongkorn University (CU) and Sichuan Agricultural University (SAU) during 1993-1996, pp. 17-25.

Kamonpatana, M., Timsard, V., Pansin, C., Sravasi, S., Srisakwattana, K. and Cox, R.I. 1985. Effect of oestrone-3-CM-HSA immunization in swamp buffalo heifers on ovarian cyclicity and fertility. Buffalo Journal 1 (2) : 145-152.

Kamonpatana, M., Timsard, V., Pansin, C., and Cox, R.I. 1985. Steorid immunization in the swamp buffalo: potential for subfertile recovery. Buffalo Jounal 1 (1) : 53-60.

Kamonpatana, M., Pansin, C., and Sophon, S., Jetana, T., Sravasi, S. and Thongpun, R. 1988. Enhancing fertility in swamp buffaloes on small farms by mean of active immunization : steroid-link protein. Buffalo Journal 4 (2) : 99-115.

Kamonpatana, M., Sophon, S., Pansin, C., Suthikrai, W. and Sravasi, S. 1988. Pregnenolone-link-protein an immunogen to increase

growth rate : A comparison between cattle and buffaloes. Buffalo Journal 4 (2) : 117-129.

Kamonpatana, M., Sophon, S., Pansin, C., Suthikrai, W. Thongruay, S., Jetana, T., Doungtanan, B., Tasripoo, K., Nuounchoen, V., Pantone, S., Paladsingh, M. 1990. Industrial uses of vaccine based on steroids immuno-neutralization to increase buffalo and cattle productivity. Buffalo Journal 6 (2) : 221-235.

Kamonpatana, M. 1996. Discovery of MATO for enhancing animal productivity and reproductivity. Animal and Plant Technology : Proceedings of the seminar held at Sichuan Agricultural University, Yaan, Sichuan, People's Republic of China, during 6-10 May 1996 under the framework of Technical Exchange between Chulalongkorn University (CU) and Sichuan Agricultural University (SAU) during 1993-1996, pp. 199-216.

Kamonpatana, M. 1998. Mato-Matid Technology mediated for optimum biological activities. Buffalo Journal 14 (1) : 115-135.

Nualchuen, W. and Kamonpatana, M. (1996). Effect of MATID on enhancing fertility of holstein friesian crossbreed cows. Animal and Plant Technology : Proceedings of the seminar held at Sichuan Agricultural University, Yaan, Sichuan, People's Republic of China, during 6-10 May 1996 under the framework of Technical Exchange between Chulalongkorn University (CU) and Sichuan Agricultural University (SAU) during 1993-1996, pp. 97-102.

Pansin, C. 2000. Molecular genetics approach buffalo improvement. Proceedings of the 1st International Congress on Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden Jubilee Building, Bangkok, 14-17 November, 2000. pp. 249-254.

Parnpai, R., Tasripoo, K. and Kamonpatana, M. 1999. Development of cloned swamp buffalo embryos derived from fetal fibroblasts : comparison in *vitro* cultured with or without buffalo and cattle oviductal epithelial cells. Buffalo Journal 15(3) : 371-384.

Parnpai, R., Tasripoo, K. and Kamonpatana, M. 2000. Developmental potential of cloned bovine embryos derived from quiescent and non-quiescent adult ear fibroblasts after different activation treatment. Theriogenology 53 : 239.

Parnpai, R., Tasripoo, K. and Kamonpatana, M. 2000. Comparison of cloning swamp buffalo embryos using fetal fibroblasts and granulosa cells as donor cells. Proceedings of the 14 th International Congress on Animal Reproduction, Stockholm, Sweden, July 2-6, 2000. Vol. 2 : 241. (Abstracts).

Parntone, S. and Kamonpatana, M. 1996. Enhancing calving rate in repeat breeders of Holstein Friesian crossbred cows using MATID in small farm. Animal and Plant Technology : Proceedings of the seminar held at Sichuan Agricultural University, Yaan, Sichuan, People's Republic of China, during 6-10 May 1996 under the framework of Technical Exchange between Chulalongkorn University (CU) and Sichuan Agricultural University (SAU) during 1993-1996. pp. 103-108.

Sophon, S. 2000. From embryo transfer to milk production in Thailand. Proceedings of the 1st International Congress on Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden Jubilee Building, Bangkok. 14-17 November, 2000. pp. 265-269.

Srisakwattana, K. 2000. Prospects utilization of monoclonal antibodies in agriculture for a better community. Proceedings of the 1st International Congress on Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden Jubilee Building, Bangkok, 14-17 November, 2000. pp. 253-262.

Suthikrai, W. 2000. Initiation of radioimmunoassay to develop agricultural community. Proceedings of the 1st International Congress on Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden

Jubilee Building, Bangkok, 14-17 November, 2000. pp. 271-279.

Tasripoo, K. 2 000. Value of "ING" Proceedings of the 1st International Congress on Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden Jubilee Building, Bangkok, 14-17 November, 2000. pp. 469-471.

Usawang, S. 2000. Mobile university : integration of local wisdom to advance technology. Proceedings of the 1st International Congresson Ideal Graduates Integrated to 4th National Congress on Thai Ideal Graduates, The Royal Golden Jubilee Building, Bangkok, 14-17 November, 2000. pp. 461-468.