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ROLE OF STANDARDIZATION IN THE AGRICULTURAL DEVELOPMENT OF INDIA*

B. N. SINGH
Indian Standards Institution, New Delhi

I wish to express my deep gratitude to the Indian Society of Agricultural Statistics for inviting me to deliver the Dr V. G. Panse Memorial Lecture at its 40th Conference at Varanasi. Dr Panse, whom I had the privilege of knowing personally, had made pioneering, versatile and outstanding contributions to application of statistical methods in agriculture and allied fields. His notable work has left a deep imprint on the statistical development in the country. He was a source of great strength and encouragement. I am really grateful for the opportunity to pay my humble tributes to him through this lecture. I also consider it a great honour to address such a gathering of learned statisticians and scientists.

The object of this address is to highlight the potentiality, versatility and achievements of standardization as also statistical methods in the development of agriculture and allied fields with particular reference to the contributions made and experience gained within the framework of Indian Standards Institution (ISI).

Agriculture is the backbone of Indian economy as 80 percent of the population residing in 576000 villages depend on it for their living. Agriculture not only provides food for the millions of the people but also it provides the raw materials for many sectors of industries and the expanding consumer markets. Our agricultural strategy has achieved remarkable success over the past decade and a half and it has to be pursued further with great vigour in the Seventh Five Year Plan so as to achieve the specified growth rate of 4 percent per annum in agricultural

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production. The public sector outlay for the agricultural sector in the Seventh Five Year Plan is Rs. 10573.62 crores which constitutes 5.87 percent of the total outlay. The target for the foodgrains production for 1989-90, that is, at the end of seventh five year plan is 178-183 million tonnes.

The green revolution was ushered in the country through the development of the high yielding varieties as also extensive changes in the various agricultural operations and practices. But in order to reap even more benefits, it is imperative to further strengthen all links in the chain, namely, efficient utilization of resources, mechanization of farm equipment, use of fertilisers and pesticides, modernization of agricultural practices used in various operations such as irrigation, cleaning, packing, storing and finally transporting agricultural products. Modernization of agricultural practices had led to considerable increase in the amount of industrial inputs which are products of our country. Thus a tremendous responsibility rests with these industries in order to build up the confidence in our farmer community.

ISI is actively engaged in the formulation of national standards in the field of agriculture and allied activities and ensuring their implementation through ISI Certification Marks Scheme. ISI is thus helping the agricultural sector in utilization of resources, enhancing productivity, improving quality, minimising loss of materials due to pests and insects, ensuring variety rationalization, optimizing the use of energy and ensuring safety to illiterate and semi-literate Indian farmers engaged in day-to-day applications of various agricultural inputs. Standardization of agricultural techniques offers an important means of ensuring efficient utilization of agricultural inputs such as seeds, fertilizers, pesticides, farm machinery and equipment required for land preparation, planting, irrigation, harvesting, threshing, processing, packaging, storing and marketing of farm products. Indian Standards prepared in these fields cover specification requirements, methods of test, codes of practice and methods of sampling.

Resource Utilization

Application of statistical methods in the standardization work has been of considerable help in the proper and efficient utilization of resources. The revision of the Indian Standard Specification for Sesame Oil (IS:547-1963) may be cited as a typical example. This standard had originally been issued in 1954 and covered the requirements for the oil obtained from the black and brown sesame seeds mostly grown in Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra and Andhra Pradesh. These seeds are also known by the local names such as Til and Gingelly. It was,

however, pointed out subsequently that the white sesame seeds, which are grown in certain areas of Tripura, Assam and West Bengal, also yield oil like the black and brown seeds and hence could profitably be utilized. For this purpose, it became necessary to examine whether the characteristics of white seasme oil differ significantly in requirements from those prescribed in the original standard. Accordingly, it was decided to collect relevant data, analyse them statistically and review the position in the light of the findings. The subsequent statistical analysis of the data revealed a significant difference in certain physico-chemical characteristics of the oils which called for prescribing a new set of quality limits for the white sesame oil. These limits, as statistically obtained, were recommended to the relevant ISI committee which mostly accepted them (see Table 1) and introduced another set of requirements for white sesame oil as Type 2 in the revised version of the standard, thereby enabling the utilization of white sesame seeds also (1). This standard was again revised in 1968 but the earlier requirements for white sesame oil were retained as they were still holding good.

TABLE 1—SOME REQUIREMENTS FOR SESAME OIL

Sl. No.	*Characteristics*	*Black and Brown Oil*	*White Oil*	
			Statistically Obtained	*Finally Prescribed*
(i)	Refractive index at 40°C	1.4645 to 1.4665	1.4662 to 1.4694	1.4662 to 1.4694
(ii)	Specific gravity at 30°/30°C	0.915 to 0.919	0.916 to 0.923	0.916 to 0.923
(iii)	Saponification value	188 to 193	184 to 190	185 to 190
(iv)	Iodine value (Wijs)	105 to 115	116 to 122	115 to 120
(v)	Unsaponifiable matter, percent by weight, Max	1.5	2.6	2.5

Lift Irrigation

India is a country with large resources. That a country can be potentially rich but at the same time be poor can be attributed to the failure, among others, to explore and effectively utilize the country's land resources. Substantial importance has, therefore, been attached to the development of agriculture under India's Five-Year Plans. A number of dams,

canals and wells have been constructed with a view to making water easily available to the farmers. However, it is still not possible to reach the vast interior areas of the country where people have to depend more and more on the taping of subsoil water to meet their needs.

Accordingly, lift irrigation, which requires power driven pumps for the supply of water to agricultural lands, plays an important role in the agricultural production. Two Indian Standards, namely, IS : 6595-1980 Specification for horizontal centrifugal pumps and IS : 9079-1979 Specification for monoset pumps for agricultural purposes, have been prepared to ensure the quality of pumps manufactured in the country. Besides general design and performance requirements of pumps, maximum levels of energy consumption have been specified in these standards. The minimum efficiency of pumps on duty points as declared by the manufacturer have also been laid down. A micro-level field study conducted by Institute of Cooperative Management (ICM), Ahmedabad had indicated that about 95 percent of the farmers sampled were not aware of the technical know-how of pumps. To provide guidelines for the selection, installation, operation and maintenance of pumps, an Indian Standard (IS: 9694-1980) has been published in four parts.

The existing 90 lakh pump sets and the 40 lakh pumps to be added in the Seventh Five Year Plan are a gold-mine for energy conservation. Studies conducted by various agencies in the past have revealed that more than 80 per cent of electric or diesel pump sets are operating at a very low efficiency. In fact, fuel consumption of faulty pump sets is 1.5 to 2.0 times that of normal consumption of diesel for similar work. Likewise, there is a considerable potential of saving energy in the case of faulty pumps operated on electricity as well. It is estimated that the energy savings to the extent of 30 per cent which would work out to 30,000 crores units of power can be effected, if the various measures suggested in the relevant Indian Standard are taken in operation of the agricultural pump sets.

These savings will meet the goals of national policy in this field emphasised in different forums. The Prime Minister in an interview in March 1985, expressed the view that our pumps which are using almost 40% of our electricity in the agricultural sector, use about three times the amount of power to pump the same amount of water that a new pump uses. He felt that the power we are putting down into such pumps constitutes a waste of people's money. This clearly emphasises the imperative need of adopting the measures suggested in the relevant Indian Standards.

Diesel Engines

A large number of diesel engines (about 90 per cent) manufactured in India are being used as prime movers in driving pumps for irrigation

purposes. It is therefore imperative to ensure proper quility and performance of diesel engines so that they give satisfactory and troublefree service to the farmers and other consumers, both in India and abroad, for reasonable periods. As a result of the implementation of the Indian Standard (IS:1601-1960) by manufacturers and testing laboratories, to which successful operation of the ISI Certification Marks Scheme gave considerable impetus, substantial improvement was made in the quality of diesel engines. IL:1601–1960 was later replaced by a set of two standards, namely, IS:10001-1981 and IS:10002-1981 taking into account the process capabilities and improved quality and performance of the engines manufactured in the country.

Before the commencement of the ISI Certification Marks Scheme, specific fuel consumption (SFC) values of diesel engines were generally quite high. However, as a result of the operation of the certification marks scheme as also increasing preference given by certain financial institutions and State governments to ISI marked engines with lower SFC values, the manufacturers had made conscious efforts to bring down the SFC values of the engines, particularly during the last few years. They modified the design of the diesel engines, where necessary; revised the tolerances, where imperative; enforced better selection of components; effected other improvements in the manufacturing techniques; and ensured better quality control and inspection. As a result, they were successful in bringing down the SFC values considerably, more so in respect of the small diesel engines for agricultural and allied purposes. Although the extent of reduction in the SFC values varies from firm to firm, 15-22 present reduction was not uncommon. When I had estimated the average savings in fuel consumption accruing from lower SFC values of the diesel engines marked in 1980-81 for agricultural and allied purposes the savings came out to Rs. 990 million a year (2). Taken cumulatively for different years, the economic saving resulting from ISI marked diesel engines would be much more. ISI certification of diesel engines has thus been making significant contribution not only to the conservation of energy and fuel economy of the country but also of the countries which have imported these engines.

Tubewells

To provide guidelines for the construction and testing of tubewells, IS: 2890-1979 has been published in two parts. Whereas Part 1 of the standard relates to their construction and covers various type of tubewells, Part 2 deals with testing and covers measurement of parameters like tubewell depth, water level, verticality, alignment and yield. In order to take care of the problems of hilly areas of the country, need

was felt for designing some new mechanical and effective water lifting devices in such areas. A hydraulic ram can pump water to a greater height without any external source of energy. ISI has published Indian Standard on requirement for hydraulic rams (IS:10809-1984) and a code of practice for installation, operation and maintenance of hydraulic rams (IS:10808-1984).

Farm Mechanization

Agricultural planners have realized that the increase in agricultural productivity through biological means has reached a saturation point and further impetus to agricultural production can be given only through the introduction of selective and proper mechanization. Though the technical aspect of mechanization is often over-shadowed by economic and social considerations, better engineered yet low cost tools and equipments are of utmost importance. ISI has been preparing national standards in the field of farm mechanization since 1959. All efforts have been made to follow the basic principles of standardization like interchangeability, rationalization, cost reduction, simplification, safety and above all consumer protection.

Import Substitution

It is very important to ensure dimensional and functional interchangeability of machinery components, while formulating Indian Standards for agricultural machinery. Some examples are : Indian Standards on tillage discs, shovels, ploughshares and knife sections for grain harvesting machines.

Import substitution has been one of the main objectives of the Five-Year Plans. In the field of farm mechanization, it could be achieved through standardization. On the basis of relevant data collected from Steel Plants in India, the Indian Standard on tillage disc was revised in 1972 which helped in the development of indigenous steel industry for catering to the need of disc industries. This standard has since been further revised in 1985 in the light of experience gained. In a study conducted by the Ministry of Agriculture on the advice of Planning Commission regarding the economic benefits of standardization arising from the implementation of Indian Standard on agricultural discs, it was observed that by raising the production of discs from 20,000 to 30,000 per annum and by implementing the Indian Standard, an over all price reduction of 32.2 percent could be achieved. In this process of standardization, the number of varieties of discs was also reduced from 16 to

6 which brought about further benefits by way of longer runs of production, better quality control and lesser storage problems.

Fertilizers

About 75 percent of our cultivable lands are rainfed. They comprise of varying soils with uneven and low rainfall distribution, varying crops, varying skills and attitudes. It is well known that the yield of crops depends on the nature of soil, inputs, crop (variety), climate and management. In other words, proper soil and crop husbandary are prerequisites before using external inputs as critical supplements. And one such important external input is the chemical fertilizer. The Fertilizer Control Order (FCO), 1957 regulates manufacture, sale, distribution and quality of fertilizers in the country. ISI has formulated 33 Indian Standards on fertilizers including product specifications, methods of test, sampling and codes of practice for handling bagged fertilizers. Product specifications prepared by the Ministry of Agriculture for inclusion in FCO take into account the relevant Indian Standard and in the case of Indian Standard on methods of test for fertilizers, FCO make a reference to it.

Pesticides

In addition to many factors responsible for low crop yield in India, the loss of production due to various plant diseases, pests, insects and rodents also account for a substantial portion. The National Council for Applied Economic Research (NCAER) on the basis of experiments undertaken in 7 states during 1951-52 and 1965-66 estimated that the maximum loss due to pests to the cotton crop is to the extent of 40 percent, for crops like paddy, jowar, sugarcane and potato, it is between 9 to 12 percent while it is lowest for wheat i.e. 3 percent. A substantial amount of foodgrains is lost due to insect infestation and rodents menace. This is specifically so in view of our tropical climate and poor storage conditions. This results into a further loss of finished foodgrains of 5-10 percent which is more serious and can be easily avoided.

ISI paid attention to this problem as early as in 1953 and decided to prepare specifications for various technical grades and formulations of pesticides. It has so far brought out about 200 Indian Standards on different types of pesticides covering dust powders, water dispersible powders, emulsifiable concentrates, water soluble powder, granuels and fumigants. Currently the work is going on developing a standard on synthetic pyrethroids recognized as a fourth generation pesticide. Adequate and functional packing of pesticides—technicals and their

formulations—becomes as important as technical specifications on quality requirements. An Indian Standard (IS;8190) for laying down uniform packaging system has been published in 4 parts—Part 1 covering solid pesticides, part 2 liquid pesticides, part 3 household pesticides and part 4 fumigants. This has resulted in making available the pesticides of desired quality to the poor farmers in a standardized and safe pack. Indian Standard on code of practice covers aspects such as general and specific care required in handling and storage of agricultural produce and inputs.

While prescribing the specification requirements for material, the ever present question is how to secure agreement between diverse interests on the quality levels for the material. The statistical analysis of the quality data collected systematically by standards bodies from different manufacturing units has been found to help considerably in securing this agreement. Such data are often available with manufacturers and with little extra effort they can be summarised for the guidance of technical committees.

It is heartening to note that pesticide industry has responded whole heartedly by adopting the voluntary ISI certification marks scheme. ISI has so far granted 1045 licences covering 335 units for different types of pesticides. The use of statistical methods help in the preparation and review of scheme of testing and inspection attached with each licence, thereby ensuring the manufacture of pesticides of satisfactory and uniform quality.

Agricultural Produce Processing

ISI set up a technical committee in 1975 to prepare Indian Standards on equipments for primary processing operations, like, cleaning, grading, drying of grains and miscellaneous equipment for operations like, sugarcane crushing, chaff cutting, maize shelling, etc. Recently, the scope of the committee had been enlarged to cover flour and dal (pulse) milling and oil milling as well as extraction machineries. This committee has so far prepared about 20 standards. Various equipments such as dryers, precleaners, shellers are predominantly used and indigenous industry has developed not only to cater to the needs of our country but is also capable of exporting to the other countries. Standardization has been well recognised as a tool for quality production and export.

Processing of agricultural produce is one of the very important operation under the post-harvest technology. This can reduce not only the food losses but also would add to the food value as well. Much progress has been made under standardization of various processing machines of desired quality in the country. Increased adoption of these

standards would pave the way for the production of the equipments of still better quality.

Safety

Increasing use of agricultural machinery in India, particularly, power threshers, tractors, chaff-cutters and sugarcane crushers has also brought about an increase in the number of accidents during their usage. Punjab Agricultural University, Ludhiana conducted a survey of thresher accidents during the wheat threshing season of 1976. Out of 800-900 accidents, 294 cases were examined and it was observed that the factors responsible were as given in Table 2.

TABLE 2 FACTORS FOR THRESHERS ACCIDENTS

Sl. No.	*Factors*	*Percentage*
(i)	Human	72.9
(ii)	Machine	12.9
(iii)	Crop	9.0
(iv)	Situational	5.2

While the mechanisation of threshing operations in the country led to increase in agricultural output, it had also brought in its wake a spate of accidents. Due to use of unsafe threshers, a large number of persons were either maimed or seriously injured. This situation attracted attention in the Parliament and elicited wide-spread public anxiety.

In view of the importance of this and seriousness of the accidents, it was considered appropriate by ISI to bring out standards on requirements for safe feeding systems for power threshers and also on general and safety requirements for power threshers. The safety standards include safe feeding system to be attached to the power threshing machines such as feeding chute, feeding hopper, etc. The standars on general requirements cover aspects of safety marking on the machine as also precautions during operation.

Indian Standard Code of Practice for installation, operation and preventive maintenance of power threshers is a very comprehensive standard including details of installation of prime-mover, details to be checked by the buyers of the threshers, guidelines for installation of power threshers, safety precautions to be observed in its operation as also on important aspect of preventive maintenance. In addition, an Indian standard has

recently been brought out to illustrate the safety and other precautionary notices with pictorial representations so that even non-educated user can understand the meaning of these notices.

Since implementation of these standards on voluntary basis was not encouraging, the Government of India issued a Quality Control Order under the Essential Commodities Act. This Order prohibits manufacture, storage for sale, selling or distributing any power threshers which do not conform to the requirements of the standards mentioned above. Consequent upon the issue of this Order, a large number of manufacturers approached ISI for obtaining licences under the Certification Marks Act. This Order has now been replaced by the Dangerous Machines (Regulations) Act. 1983. At present nearly 150 manufacturers have taken ISI licence for manufacturing the threshers with improved safe feeding system specified in the relevant Indian standards. As a result of vigorous standardization and certification efforts, the number of accidents in the use of power threshers came down from 988 in 1981-82 to almost nil. In fact since 1983-84, there have been no reports of accidents in the use of power threshers.

Safety aspects in the use of agricultural tractors have also been adequately covered in Indian Standards. These standards cover designfeatures indicating operator's workplace, location of various controls, guarding of hazardous components, and code of practice for installation and preventive maintenance of tractors. Accidents have also been reported with the chaff cutters at the blade, feeding point and in the case of power chaff cutter with the drive. In the case of animal drawn sugarcane crushers, accidents happen at the feeding point and striking of the beam on the head of the person feeding the cane or removing the baggasse. In the case of power sugarcane crushers, accidents are reported at the feed point as well as at the drive. Relevant Indian Standards adequately covered safety provisions in these cases resulting into avoidance of the accidents.

It is needless to say that the wider use of agricultural machinery, which has significantly contributed to the agricultural development of the country, could not have been possible without vigorous standardization efforts including the safety aspects.

Storage

Increase of agricultural production by itself is not adequate to provide sufficient food to the nation's population. Foodgrains once produced are to be protected from spoilage till they are consumed. Therefore, scientific post-harvest handling and storage operations become important. Foodgrains saved are foodgrains produced. The relevant technial com-

mittee of ISI has formulated a number of Indian Standards related to various types of storage structures employed in the country. These standards cover bulk grains storage and bagged grain storage structures made of metal or locally available materials which are cheaper and economical. General requirements for silos for grain storage including both constructional and handling requirements, have also been covered in different standards. It is estimated that adoption of all these 25 and odd standards prepared by ISI will result in the reduction of storage losses from 10 to 2 percent.

Marketing

Efficient marketing of farm produce is vital to the economic development of India. Indian Standards have been formulated on lay-out of market yards for agricultural commodities in general and market yards for special items, such as, fruits and vegetables, tobacco, oilseeds, jute, cotton and coffee. Regulated Market Yards (RMYs) have been established under the Agricultural Produce Marketing Acts of various states in India. They provide incentive to the farmer in the form of ready market and remunerative price for all that he produces. Adoption of standard layouts would go a long way in achieving overall economy in the utilization of available resources and provide the required services to the farmers.

Conclusion

It would thus be seen that standardization and statistics have played an important part in the development of agriculture and allied activities in our country, thereby also contributing to the development of the national economy. Indian standards have also proved to be an extremely valuable and effective medium in translating the fruits of basic research, modernisation and advancements in agricultural and allied fields to actual practice, thereby bringing the advantages of advancements of science and technology even to the rural masses in the country.

India is endeavouring to enter the twentyfirst century with great emphasis on improvement of quality, enhancement of productivity, reduction of cost, expansion of exports, conservation of energy and efficient utilisation of resources. Hence standardization and statistics would assume even greater significance. In fact, a judicious blending of agricultural, engineering, technological and statistical judgement as also bold and dynamic action would be able to push ahead the frontiers of knowledge in various fields and thereby bring about significant improvements for the benefit of all.

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