

## Research Article

# QUALITY DOUBLE HYBRID SEED BY NATIONAL SILKWORM SEED ORGANIZATION FOR POPULARIZATION OF BIVOLTINE SERICULTURE IN CHITTOOR DISTRICT OF ANDHRA PRADESH

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## ABSTRACT

Chittoor district which occupies first position in Mulberry sericulture in Andhra Pradesh is in the Rayalaseema region where the temperature goes up to 47°C in summer months. In spite of water scarcity and low rainfall in the recent past, mulberry cocoon production sustained due to quality silkworm seed. NSSO has 20 SSPCs managed by well qualified scientists to create a new record in the seed production year after year. Bivoltine Double Hybrid Silkworm Seed have contributed for the sustenance and higher returns to the sericulturists. Grainage performance with the recovery of Dfls above NSSO norms as per the quality standards of ISO-9001:2015 has enhanced the returns from sericulture. The Bivoltine seed production by NSSO is appreciable as reflected in the Compounded Annual Growth rate (CAGR) of 17.21% for the past 5 years. The Bivoltine Dfls production by NSSO was 195.45 lakhs during 2013-14, 251.57 lakhs during 2014-15, 309.70 lakhs during 2015-16, 342.77 lakhs during 2016-17 and 314.32 lakhs during 2017-18 which clearly shows the continual improvement in production. The Egg recovery per 1 kg of Seed cocoon was well above the norms set for NSSO (65gms) in the grainages for the period from 2013-14 to 2017-18 which clearly defines the efficient utilization and management of Seed cocoons which has made the Bivoltine production economically sustainable. Present study was conducted in Chittoor cluster in Andhra Pradesh in 10 mandals i.e. Chittoor, Penumuru, Bangarupalem, Thavanampalle, Irala, Gudipala, Puthalapattu, G.D. Nellore, Pakala and Palasamudram. The paper deals with 5 years comparative data in Bivoltine Double Hybrid NSSO source Dfls brushing, Dfls harvesting, Average yield and Silk productivity since 2013-14 to 2017-18 in Chittoor cluster which shows continual improvement. The study reveals that the Dfls brushing was 82175 during 2013-14 which was increased to 110000 during 2014-15, 160400 during 2015-16, 249000 during 2016-17 and 443000 during 2017-18. Seed Cocoons harvested was 54.727 MT with an Average yield of 67.400 in 2013-14, 76.802 MT with an average yield of 69.820 in 2014-15, 102.988 MT with an average yield of 71.150 in 2015-16, 184.190 MT with an Average yield of 73.970 in 2016-17 and 313.400 MT with an Average yield of 75.900 in 2017-18. The study shows that quality Bivoltine Double hybrid NSSO source Dfls has enhanced the productivity and popularized the Bivoltine production in Chittoor district.

## INTRODUCTION

The silkworm seed sector is the sheet anchor of sericulture industry and the Silkworm Seed Production Centres of NSSO play a pivotal role in the production and its distribution. The relentless efforts of the personnel and the team spirit prevailing at Silkworm Seed Production Centres have paved the way for NSSO to create a new record in the

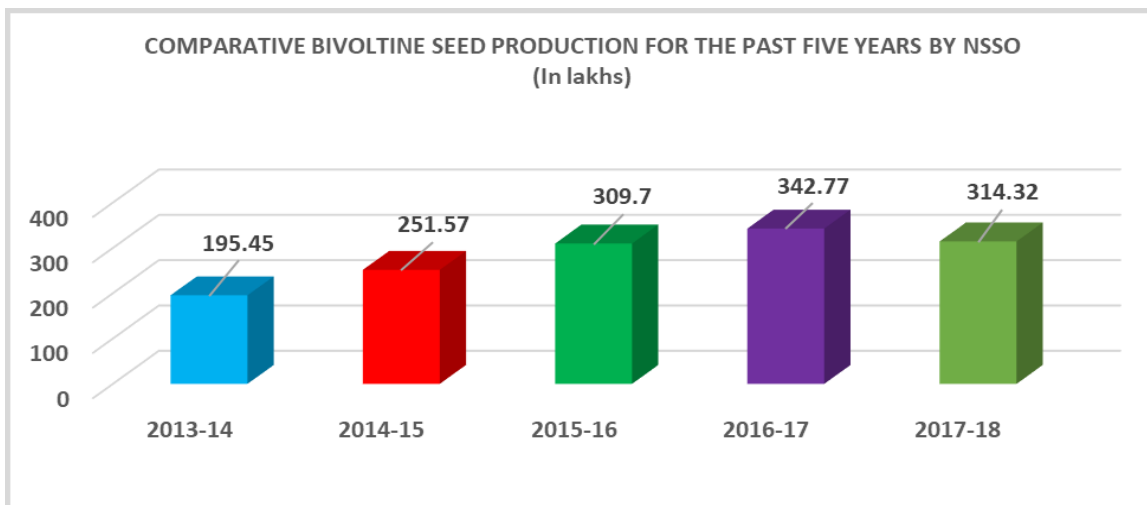
seed production arena every year. Silkworm hybrid reared is an important and vital factor in determining the quality of silk yarn produced and to be sold in the international market. Silkworm eggs are the vital inputs for the production of cocoons in the silk industry. It is well documented that F1 hybrids are superior to their parents in

many qualitative and quantitative characters. Assured supply of quality silkworm seed is the pre-requisite for production of the targeted raw silk of desired quality. If this is not in order, all subsequent exercises will prove futile. Owing to the existence of negative correlation between high cocoon shell percentage and low pupation rate in pure races, the handling of these races needs more care and attention by seed cocoon farmers. Utilization of Foundation hybrids (FCs), has been suggested considering their advantages of ease in rearing, uniform and robust larval growth, higher pupation rate and increased egg recovery in double hybrids (Basavaraja et al., 1995). Keeping this in view the Double hybrid (CSR6 X CSR26) X (CSR2 XCSR 27) has been commercially produced in 11 southern grainages certified ISO 9001:2015 under NSSO managed by well qualified and experienced scientists (Reddy et al., 2005). Silkworm Seed Production Centres under NSSO produce the Double hybrid Dfls following the norms set by NSSO, Central Silk Board for purchase of seed cocoons, Egg recovery of silkworm eggs, Dfls preservation schedules and guidelines of ISO for quality. All the NSSO grainages are 30 lakhs capacity with the same Infrastructure, Equipments, Scientists, Technical staff, Ministerial and Multi-tasking staff and Skilled Farm Workers to carry out the various functioning. The SSPCs under NSSO produces Double hybrid Dfls with Egg recovery above 65 gms per 1 kg of Seed cocoons and with

least Cost of production by meticulous planning and execution. The Double hybrid has more genetic plasticity to buffer/ withstand the fluctuating environmental condition and thereby resulting in crops stability (Nirmal Kumar et al., 1998 & 1999). In this context, it is necessary to know the impact of Double hybrids and their acceptance by the farmers for further development and popularization of the race in new areas.

**MATERIALS AND METHODS**

Comparative Bivoltine Seed Production and Productivity by NSSO since 2013-14 to 2017-18, Comparative Seed Production and Productivity by SSPC, NSSO, Chittoor since 2013-14 to 2017-18 and 5 years comparative data in Bivoltine Double Hybrid NSSO source Dfls brushing, Dfls harvesting, Average yield and Silk productivity since 2013-14 to 2017-18 in Chittoor division was analysed in the present study. The study was conducted in Chittoor division in Andhra Pradesh in 10 mandals i.e. Chittoor, Penumuru, Bangarupalem, Thavanampalle, Irala, Gudipala, Puthalapattu, G.D. Nellore, Pakala and Palasamudram. From each mandal 12 sericulturists (4 big, 4 small and 4 marginal) were selected purposively based on their acreage. A total of 120 sericulturists were interviewed using pre-tested schedule during 2018 to know the socio-economic impact of NSSO source Double hybrid Dfls on sericulturists.



**Fig. 1. Comparative Bivoltine Seed Production for the past five years by NSSO**

**RESULTS AND DISCUSSION**

Bivoltine Hybrid Dfls production by NSSO has tremendously increased from 195.45 lakhs in 2013-14 to 314.32 lakhs in 2017-18 which is contributing to the major share of Bivoltine raw silk production in the country, in line with the country’s ambitious raw silk production target (Chart-1). The productivity has increased from 61.23 gms/1 kg of Seed cocoon in 2013-14 to 75.17 gms/1 kg of seed cocoon in 2017-18 (Chart-2). The growth trend for

Bivoltine silkworm seed production by NSSO is commendable by any standard as reflected in the Compounded Annual Growth Rate (CAGR) of 17.21% for the past 5 years. NSSO could grow at this fast pace because of the Dfls Quality and greater acceptance of the brand which is indication of the trust reposed in the organization by the sericulturists. Based on the conditions prevailing, availability of infrastructure, trained manpower and raw materials, seed production targets were fixed for individual

SSPCs. The production targets given to silkworm seed production centres of southern India were mostly of bivoltine silkworm seed owing to the growing acceptance for bivoltine sericulture and also the expertise available in large scale commercial bivoltine loose egg production.

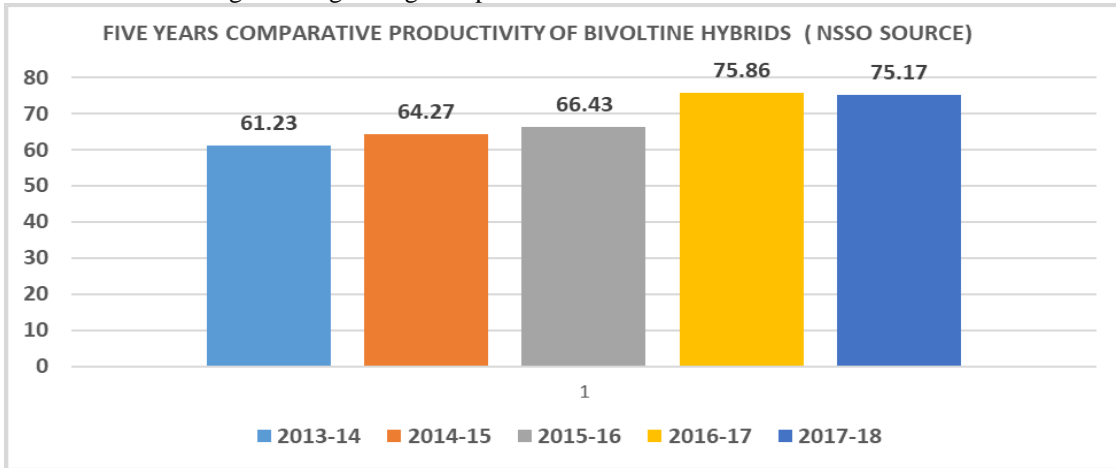


Fig. 2. Five years comparative productivity of bivoltine hybrids

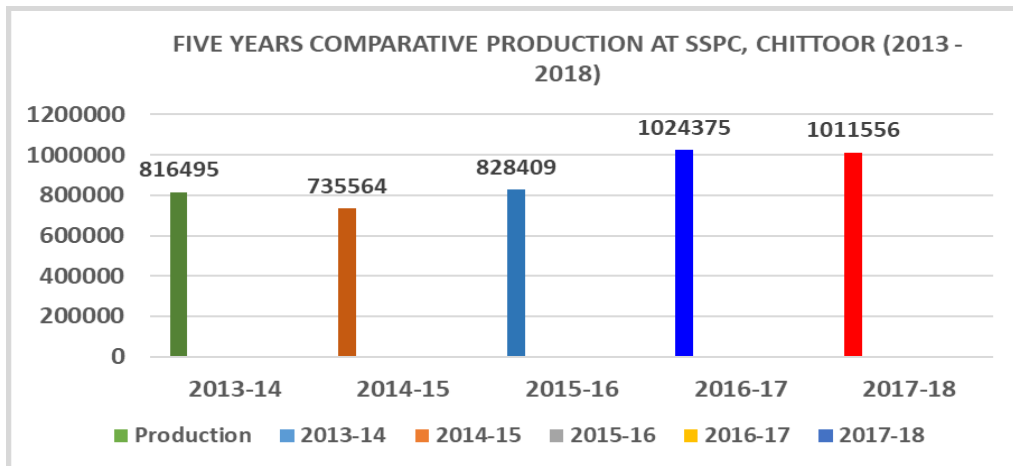


Fig. 3. Five years comparative production at SSPC, Chittoor

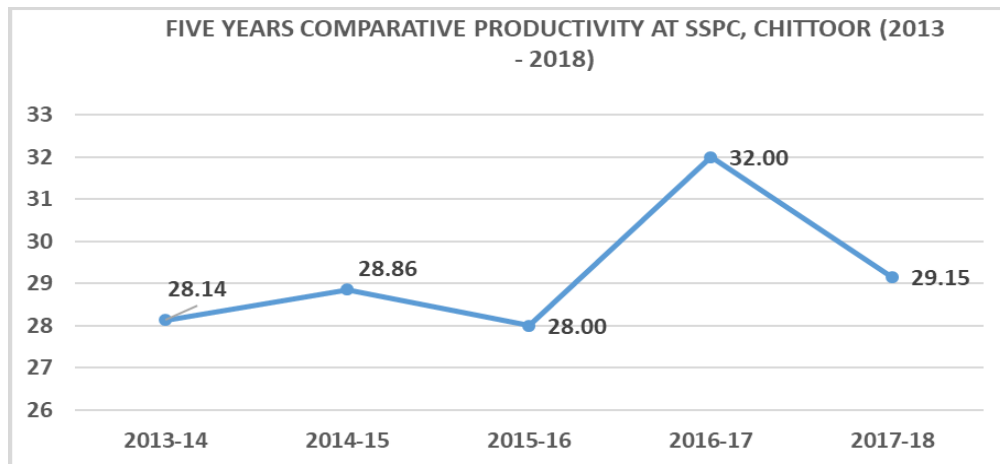


Fig. 4. Five years comparative production at SSPC, Chittoor

The Silkworm Seed production in the hottest zone of Rayalaseema region at SSPC, Chittoor has increased from 8.16 lakhs in 2013-14 to 10.12 lakhs in 2017-18 and productivity has increased from 28.14 % in 2013-14 to 29.15 % in 2017-18 (Chart-3 & 4). Being certified with QMS ISO 9001: 2015, the centre maintained the set quality standards which has resulted in recovery % of Dfls above norms. The main objective of SSPC, Chittoor was

production and supply of quality disease free silkworm seed, and popularising Bivoltine hybrids, introduction of sericulture in potential areas, timely supply of silkworm seed and critical inputs to keep up the confidence of sericulturists and play a role model in transfer of technology to help farmers to increase the vertical growth by adopting recommended package of practices.

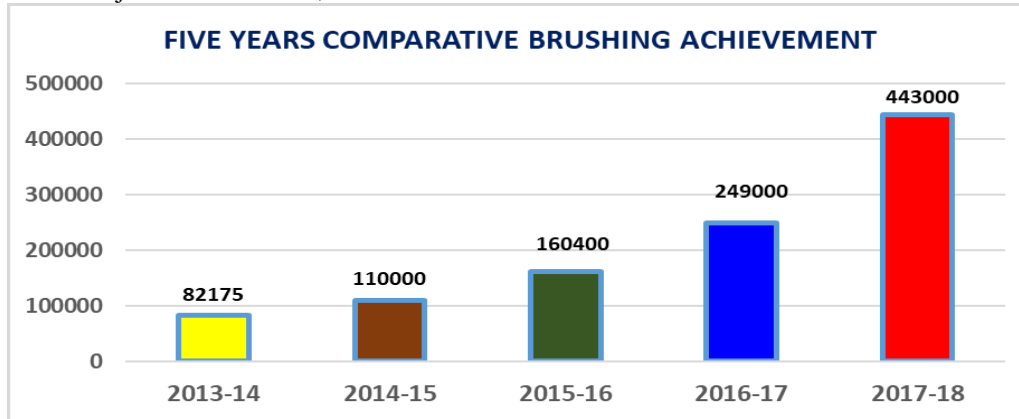


Fig. 5. Five years comparative brushing achievement

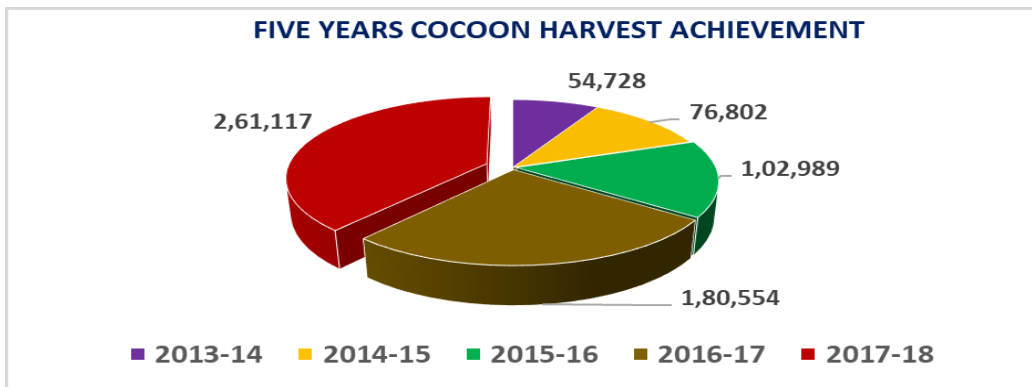


Fig. 6. Five years cocoon harvest achievement

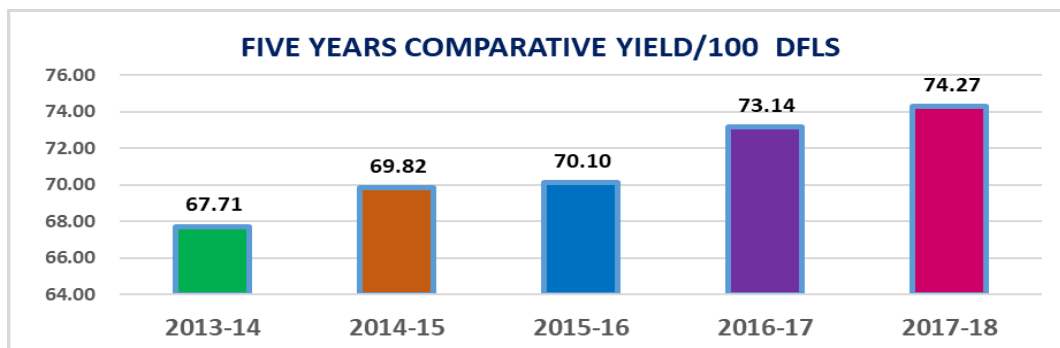


Fig. 7. Five years comparative yield/100 DFLS

As a part of Cluster Promotion programme to popularise bivoltine hybrids, bivoltine double hybrids of NSSO source was brushed in the Cluster CRC and supplied to sericulturists batch wise after Chawki certification regularly

since 2013-14 to 2017-18. The 10 mandals under the study were rearing traditional Cross Breed Dfls till 2013-14 and the sericulturists in the villages has switched to bivoltine Double hybrids as the NSSO double hybrids has given

excellent yield. The Chart-5 clearly depicts that Brushing of Double hybrid Dfls of NSSO source has increased from 82175 during 2013-14 to 443000 during 2017-18 (Joge *et al.*, 2003). The continual improvement and increase in Brushing of Double hybrid Dfls is mainly due to the quality as the Double Hybrid Dfls are ISO certified. Dfls harvested has increased from 54728 during 2013-14 to 261167 during

2017-18 and there was no crop failures, which proves the consistency in performance of Double hybrid dfls of NSSO source (Chart-6). Average yield (Yield/100 Dfls) has increased from 67.71 kgs in 2013-14 to 74.27 kgs in 2017-18 which shows continual improvement in yield and consistency in performance of double hybrid Dfls (Mahalingappa *et al.*, 2003) (Chart-7).

**Table 1. Five years comparative performance of NSSO double hybrid DFLS at Chittoor**

Particulars	2013-14	2014-15	2015-16	2016-17	2017 - 18
BRUSHING TARGET	50,000	75,000	1,20,000	1,50,000	2,90,000
DFLS BRUSHED	82,175	1,10,000	1,60,400	2,49,000	4,43,000
% OF ACHIEVEMENT	164.35%	146.66%	114.57%	116.00%	152.76
HARVESTING TARGET	32500.00	48750.00	72000.00	97500.00	188500.00
COCOONS HARVESTED	54727.00	76802.00	102988.00	180554.00	313402.00
% OF ACHIEVEMENT	168.39%	163.42%	143.03%	185.18%	166.26%
RATE/KG	391.23	341.55	286.69	406.59	477.25
YIELD/100 DFLS	67.70	69.82	70.16	73.14	75.90
EXTN. PROGRAMES	18	25	31	38	43

**Table 2. Impact of rearing double hybrid DFLS of NSSO on socio-economic status of sericulturists in study area**

PARTICULARS	IMPACT (%)
Purchase of additional land	32
Extension of Mulberry garden	38
Irrigation	29
Shifted to New Mulberry variety (G2)	24
Purchase of rearing equipment	72
Other Assets	68
Change in status(Member/President/Secretary in village organizations)	52

Double Hybrid Dfls of NSSO has made its impact on sericulturists both in terms of social as well as economic benefits (Geetha *et al.*, 2001) (Table-2). The higher yield and higher rate per kg of cocoon had induced sericulturists to buy additional land (32%) or extend the mulberry garden (38%) (Hiriyanna *et al.* 2002). Some sericulturists increased the irrigation facilities to the garden (29%) and a few shifted over to the new mulberry variety G2 (24%). The income received from sericulture was re-invested by the sericulturists for the purchase of rearing equipment (72%) and other assets (68%). Their professional approach to Silkworm rearing influenced them to improve their social status in terms of occupying important positions in village organizations (52%).

## CONCLUSION

Wide and sudden fluctuations in the environment coupled with poor quality mulberry and management practices by the farmers under tropical conditions necessitated the requirement of double hybrids. The primary objective of rearing double hybrids is to get the desired quantitative and

qualitative traits into one combination. It is well known that survival and fecundity are affected greatly with increase in quantitative traits beyond threshold level. Unless mother moth is a hybrid, the fecundity cannot be increased. The increase in egg number is possible only with the foundation crosses, which are the parents of double hybrids. In addition, with clear advantage like easy rearing, superior to parental breeds in growth, vigour and other economic characters besides better in yield, the double hybrids is commercially exploited. Heterosis in fecundity of Double hybrids over Foundation crosses is reported considerably high. Hence the foundation crosses at P1 level could eventually increase the commercial seed production. This approach is adopted to bridge the gap of commercial seed production and quality. The benefit by the use of Double hybrid is -

- Increased crop stability if foundation crosses are raised and reared at P1 level especially in unfavourable seed crop season.
- Increase in number of eggs up to an extent of 20% promoting an enhanced egg production.

- Seed crop rearers will not hesitate to accept the foundation crosses because of crop assurance.

Of late, the Tetra parental bivoltine hybrids popularly known as Double hybrids have gained wider acceptance in India and majority of NSSO production now comprises of Double Hybrid Dfls. In spite of low predictability of diseases and involvement of higher risk, sericulturists in Chittoor district has taken up rearing Double hybrid Dfls of NSSO because of better rate per kg of cocoons which in turn enhanced their social and economic status.

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