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Impact on autumn crop through introduction of summer crop under North West India

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Abstract

The present investigation was conducted at Regional Sericultural Research Station, Miran sahib, Jammu for introduction of summer crop and to study the impact on autumn crop. The hybrid, SH₆×NB₄D₂ was shortlisted for field trial of summer and autumn season (2020) from the evaluated hybrids during previous studies (2018 & 2019) at RSRS, Jammu and the DFLs were procured from SSPC, Dehradun and were incubated at RSRS, Jammu and REC, Ghumarwin (H.P). The chawki reared worms were distributed to each location of Lamberi (Rajouri Dist.), Dharmakot (Kathua Dist.) and Majalta (Udhampur Dist.) at Jammu division and Soi, Panol & Naswal (Bilaspur Dist.) & Sanot (Kangra Dist.) at Himachal Pradesh having totally nine selected rearers provided with 50 DFLs (20000 worms) per rearer. The average yield recorded during summer crop of about 44.40 Kg/100 DFLs at Jammu division whereas Himachal Pradesh with average yield of about 35.35 Kg/100 DFLs was recorded and control batch reared at RSRS, Jammu was recorded yield about 51.87 Kg/100 DFLs during summer crop whereas autumn crop an average yield recorded of about 40.80 Kg/100 DFLs at Jammu division whereas Himachal Pradesh with average yield of about 43.67 Kg/100 DFLs and control batch was recorded about 44.75 Kg/100 DFLs. The impact of introduction by summer crop revealed that *percent* yield gain over traditional field rearing from experimental field trial about 67.14 (%) and 44.70 (%) yield gain record in autumn season at Jammu division and Himachal Pradesh respectively.

Keywords: summer, field, Jammu, Himachal Pradesh, yield

Introduction

Silkworm is one of the most important domesticated insects, which produces luxuriant silk thread in the form of cocoon by consuming mulberry leaves during larval period. The growth and development of silkworm is greatly influenced by environmental conditions (Gowada and Reddy, 2007) ^[6]. The variations in the environmental conditions day to day and season to season emphasize the need of management of temperature and relative humidity for sustainable cocoon production (Siddiqui *et al.*, 2005) ^[12].

Jammu Kashmir, Himachal Pradesh, Uttarakhand, Punjab and Haryana constitute the North Western sericulture zone of the country. This zone is known for exclusive bivoltine cocoon production, no doubt it has salubrious climatic condition during spring rearing season for production of high quality bivoltine cocoons and there are very few pockets in the country which may be considered as natural home for bivoltine silk. However, it has certain limitations also. Only spring crop has the climatic advantages, hence over decades the entire zones depends on this crop for its annual raw silk output. There are only two silk cocoon crops in vogue in this zone i.e. spring and autumn of which spring crop alone constitutes about 80 *percent* (except Uttarakhand) of the annual cocoon production (Singh and Murali, 2019) ^[10].

Current scenario limits the development of sericulture industry not only in terms of cocoon production but one of the reason for poor post cocoon support is because of the over dependency on single crop i.e. Spring for availability of raw materials to run the multi end reeling machines through the year. Limited cocoon crops have been major obstacle for the growth of sericulture industry in North Western India including Jammu and Kashmir. Traditionally silkworm rearing is practices in this zone is twice in a year, i.e. during spring season (1st crop) by brushing of silkworm in the first week of March and during autumn season (2nd crop) by brushing of silkworms from last week of August to first week of September. Due to sever climatic changes after October next rearing season comes only when mulberry sprouts in the month of February after winter dormancy. Silkworm enjoy fresh mulberry leaves of 50-60 days old, hence brushing of silkworm is ideal in June to explore scope of third crop & keeping intact the other two crops. Source of mulberry leaves are old giant mulberry trees and

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they are not pruned before autumn crop which adversely affect the autumn crop (Singh and Murali, 2019) [10].

In spite of the fact that the climatic conditions of Uttarakhand are congenial for bivoltine silkworm rearing specially for district Dehradun but only spring silkworm crop is being exploited at farmer's level and autumn crop has yet to be stabilized. The main reasons, as observed, are high temperature, high humidity and bad quality of mulberry leaves during autumn rearing. The temperature and humidity prevailing during rearing season could be manipulated but the leaves quality needs to be improved for silkworm rearing. Keeping in view, summer crop has been taken for study. An average cocoon production was 40.02 Kg and 36.66 Kg /100 DFLs during summer season 2018 and 2019 respectively in West Dehradun. The farmers conducting silkworm rearing in summer season harvest mulberry leaves bloomed after spring crop harvest and again a fresh harvest during autumn season. This also affects on the performance of autumn silkworm crop and sericulture activity becomes more remunerative with spring, summer and autumn crops in a row (Aslam *et al.*, 2019) [11]. The study reveals the encouraging results with an average productivity range from 30-68 Kg of cocoons /ozs during summer crop. In this crop, besides, the better productivity than autumn crop, an additional advantage of this crop is automatic pruning of mulberry trees/plants during the month of June at the time of shoot harvest during rearing as brushing date for this crop was in May. It results in the

production of quality leaf during autumn season. The above results indicate that there is a feasibility of an additional silkworm crop in this sericulture zone of Punjab, which needs to exploit it on commercially on large scale (Shashi Kanta, 2014) [11].

To explore the possibility of multiple cocoon crops under subtropical condition of North West India it is expected that introduction of a crop in between spring and autumn will forced the pruning of mulberry trees before autumn crop; hence it will help in stabilization of autumn crop and increase of yield through feeding by quality mulberry leaves under North Western India.

Material and Methods

Based on the overall rearing experiences and outcome of the diagnostic study during 2018, followed by institute level summer rearing (2019) in between spring and autumn crop, field trial was planned and conducted with the DOS sponsored farmers in given location covering 5 potential sericulture districts of North West India. Summer and autumn crop was conducted with shortlisted hybrid *i.e.* SH₆×NB₄D₂ and brushing date at Jammu and Himachal region of selected rearers at each location with actual rearing capacity of the farmers. Chawki reared worms were distributed and leaves used from the same trees for the different seasons by adopting pruning from time to time. The following Table 1 shows the rearers list and their location.

Table 1: Showing rearers selected for field trial of shortlisted hybrid (SH₆×NB₄D₂) evaluation during summer season (2020)

S. No.	Name of DOS sponsored rearers	Village	District
Jammu Division of J&K			
1	Sh. Agya Ram S/o Sh. Kutti Ram	Majalta	Udhampur
2	Sh. Rattan Chand S/o Sh. Lakshman Dass	Dharamakot	Kathua
3	Sh. Kundan Lal S/o Sh. Sunder Dass	Lamberi	Rajouri
Himachal Pradesh Division			
4	Smt. Rekha Devi W/o Sh. Vinod Kumar	Soi	Bilaspur
5	Smt. Prem Lata W/o Sh. Pritam Singh	Panol	Bilaspur
6	Smt. Salini Devi W/o Sh. Pawan Kumar	Naswal	Bilaspur
7	Smt. Sudesh Kumari W/o Sh. Pritam Chand	Sanot, Dehra	Kangra
8	Smt. Swarna Devi W/o Sh. Raj Kumar	Sanot, Dehra	Kangra
9	Smt. Tarsema Devi W/o Sh. Partap Singh	Sanot, Dehra	Kangra
Control (Lab Condition)			
10	RSRS, Jammu (J&K)	Miran Sahib	Jammu

Methodology

Farmer's level (DOS sponsored farmers in potential sericulture districts) rearing was conducted with proven technology and innovative approach, based on the outcome of experimental rearing conducted at RSRS, Miran Sahib, Jammu and RSRS, Sahaspur, Dehradun during previous years (2018 & 2019). Silkworm summer and autumn rearing among DOS sponsored farmers (9 No's) with shortlisted hybrid *i.e.* SH₆×NB₄D₂ (based on actual rearing capacity of the farmer) with overall technical and material support through RSRS, Jammu/State Sericulture Departments (DOSs) and Research Extension Centers (RECs) of CSB at identified location. DOS, J&K and DOS, HP sponsored three and six farmers respectively thus total 9 farmers with the help of State Department of Sericulture/ Research Extension Centers of CSB in three different locations of representative sericulture districts in Jammu province of Jammu & Kashmir and Himachal Pradesh where finally identified. Accordingly, farmer level rearing was with 9 farmers during summer and autumn crop in J&K and HP was conducted with five potential sericulture districts - Rajouri, Udhampur & Kathua

in J&K and district Bilaspur and Kangra in Himachal Pradesh comprising 03 farmers from each location having rearing capacity up to 50 dfls/farmer (Table 1). Control rearing (50 DFLs) for the shortlisted hybrid was conducted at RSRS, Miran Sahib, Jammu to assess research level yield and potential yield at rearer's level. The introduction of summer crop in between spring and autumn was studied and its impact on the autumn crop was analyzed.

Results and Discussion

The results of the field trial conducted at Jammu and Himachal Pradesh with DOS sponsored rearers during summer and autumn (2020) season were presented here under:

In spite of the fact that climatic conditions are suitable for bivoltine rearing, only spring crop is being exploited at farmer's level and autumn crop is not yet stabilized due to many reasons. The quality of mulberry leaves is one of the most important factors governing the production of good cocoon crop (Ravikumar, 1988) [9]. It is general tendency of the silkworm rearers during spring season to harvest mulberry

shoots during 5th instar of silkworm rearing for onward leaf plucking to feed the worms. It was observed, in the month of June, that sufficient mulberry leaves were available on mulberry trees which remain un-utilized for silkworm rearing and no pruning schedule was observed by majority of the farmers for autumn crop. Due to no crop during summer season, such mulberry leaves became over matured or of poor quality and affected adversely on cocoon production during autumn silkworm rearing. Hence, autumn silkworm crop is not sufficiently remunerative in the present scenario of the state. However, sericulture industry in Northern states of the country sustains mostly on mulberry trees existing road side, ward side, river banks and boundary plantation thereby forming a major source of foliage (Dhar and Bindroo, 1997; Dhar *et al.*, 1996; Dhar *et al.*, 2001 and Khan, 2006) [5, 3, 4, 8]. Further, change of mulberry cultivation practice from bush to tree mode in Uttarakhand (Juyal *et al.*, 2007 & Srivastava *et al.*, 2007) [7, 13], necessitates introduction of additional silkworm crop in between spring and autumn seasons. SH₆×NB₄D₂ was shortlisted for summer rearing from the evaluated hybrids during previous years (2018 & 2019) and the DFLs were procured from SSPC, Dehradun and were incubated at RSRS, Jammu and REC, Ghumarwin (H.P) and brushed on 29.06.2020 and 28.06.2020 at Jammu & Ghumarwin respectively. The chawki reared worms were distributed to each location on 12.07.2020 (Lamberi, Rajouri

Dist.), 13.07.2020 (Dharmakot, Kathua Dist.) and 14.07.2020 (Majalta, Udhampur Dist.) at Jammu division whereas Bilaspur region (H.P) worms were distributed on 07.07.2020 having 50 DFLs (20000 worms) per rearer. The yield recorded was about 44, 44 and 45.20 Kg/100 DFLs for Lamberi (Rajouri Dist.), Majalta (Udhampur Dist.) and Dharamkot (Kathua Dist.) region respectively with average yield of about 44.40 Kg/100 DFLs at Jammu division whereas 17, 16.67 and 14.60 Kg/100 DFLs for Soi, Panol and Naswal region of Bilaspur Dist., Himachal Pradesh and 42.60, 74.40, 46.80 Kg/100 DFLs for Sanot region (3 rearers) of Kangra Dist. Himachal Pradesh with average yield of about 35.35 Kg/100 DFLs was recorded. The control batch reared at RSRS, Jammu recorded yield was about 51.87 Kg/100 DFLs (Table 2). The average filament length was recorded about 725.33 mtrs, denier (2.54), Renditta (3.44), Reelability (75.48%), Raw silk (29.46%) and Neatness (89.67) at Jammu division whereas at Himachal Pradesh the average filament length was recorded about 752.00 mtrs, denier (2.26), Renditta (3.66), Reelability (69.81%), Raw silk (27.72%) and Neatness (94.67) respectively for the field trial conducted during Summer season (2020) and the control batch rearing at RSRS, Jammu the filament length was recorded about 825.00 mtrs, denier (2.62), Renditta (2.95), Reelability (78.27%), Raw silk (34.12%) and Neatness (93.00) (Table 3).

Table 2: Average Data Recorded during Summer Field trial for the Hybrid, SH₆×NB₄D₂ through Shelf Rearing (2020) at different places of Jammu & Himachal Pradesh and Control batch at RSRS, Jammu

Name of location	Date of incubation	Date of brushing	H (%)	Date of distribution	Wt. of 10 Mature Larvae (g.)	5 th Instar Larval Period (D:h)	Total Larval Period (D:h)	Actual Yield (Kg)	Av. Yield / 100 DFLs	SCW (g)	SSW (g)	SR (%)
Jammu Division (J & K)												
Lamberi, (Rajouri)	26.06.2020	29.06.2020	91.80	07.07.2020	45.03	7:00	24:00	22.00	44.00	1.819	0.351	19.29
Ramkot, (Udhampur)	26.06.2020	29.06.2020	91.80	07.07.2020	45.00	7:04	24:00	22.00	44.00	1.560	0.310	19.24
Barnoti, (Kathua)	26.06.2020	29.06.2020	90.00	07.07.2020	44.00	7:02	26:00	22.60	45.20	1.600	0.300	18.75
Avg.			91.20		44.68	7:02	24:16	22.20	44.40	1.66	0.32	19.09
Himachal Pradesh												
Soi (Bilaspur)	25.06.2020	28.06.2020	90.00	07.07.2020	40.00	7:10	27:00	8.50	17.00	1.570	0.270	17.20
Panol (Bilaspur)	25.06.2020	28.06.2020	90.00	07.07.2020	38.00	7:10	27:00	8.34	16.67	1.580	0.270	17.15
Naswal (Bilaspur)	25.06.2020	28.06.2020	90.00	07.07.2020	36.00	7:10	27:00	7.30	14.60	1.560	0.260	17.05
Sanot (Kangra)	27.06.2020	30.06.2020	95.00	09.07.2020	56.00	7:10	26:10	21.30	42.60	1.92	0.350	18.23
Sanot (Kangra)	27.06.2020	30.06.2020	95.00	09.07.2020	60.00	7:13	26:08	18.60	74.40	1.88	0.340	18.08
Sanot (Kangra)	27.06.2020	30.06.2020	95.00	09.07.2020	58.00	7:12	26:11	11.70	46.80	1.72	0.310	18.02
Avg.			92.50		48.00	7:11	26:17	12.62	35.35	1.71	0.30	17.62
RSRS Jammu (Control Batch)												
RSRS, Jammu	26.06.2020	29.06.2020	91.80	-	55.00	5:20	23:03	25.93	51.87	1.650	0.315	19.02
Avg.			91.80		55.00	5:20	23:03	25.93	51.87	1.650	0.315	19.02

Note: No. of DFLs distributed: 50 DFLs; No. of Farmers covered: 9; H-Hatching

Table 3: Showing post cocoon parameters recorded for summer (2020) trial rearing at Field and Control batch at RSRS, Miran Sahib, Jammu

Location	AFL (mtr)	Denier	Renditta	Reelability (%)	Raw Silk (%)	Neatness
Jammu division						
Lamberi (Rajouri)	639.00	2.38	3.45	75.98	29.16	93.00
Majalta (Udhampur)	849.00	2.73	3.15	72.61	32.07	93.00
Dharamakot (Kathua)	688.00	2.52	3.73	77.85	27.14	83.00
Avg.	725.33	2.54	3.44	75.48	29.46	89.67
Himachal Pradesh						
Soi (Bilaspur)	772.00	2.31	3.33	70.55	30.23	93.00
Panol (Bilaspur)	735.00	2.29	3.84	67.83	26.50	93.00
Naswal (Bilaspur)	749.00	2.18	3.82	71.04	26.43	98.00
Avg.	752.00	2.26	3.66	69.81	27.72	94.67
Control batch rearing						
RSRS, Jammu	825.00	2.62	2.95	78.27	34.12	93.00
Overall Avg.	751.00	2.43	3.47	73.45	29.38	92.29
SD±	73.36	0.20	0.35	3.99	2.96	4.50

Note: AFL – Average filament length; SD-standard deviation

Similar attempt was done for introduction of summer crop by Dar *et al.* (2006) [2] highlighted the constraints in the development of sericulture in J & K in general and for second commercial cocoon crop in particular. The management for silkworm rearing for the second crop has been highlighted. Procedure for rearing the one year or older silkworm eggs, through single and double refrigeration, for summer or preautumn silkworm rearing after 35-60 days for spring rearing has been recommended for adoption of the method. The method for the management of mulberry plantation for raising the second crop has been proposed. The cocoon yield for summer and pre-autumn silkworm rearing has been recorded as 24 and 34 Kg/oz. respectively.

The study reveals the encouraging results with an average productivity range from 30-68 Kg of cocoons /ozs during summer crop. In this crop, besides, the better productivity than autumn crop, an additional advantage of this crop is automatic pruning of mulberry trees/plants during the month of June at the time of shoot harvest during rearing as brushing date for this crop was in May. It results in the production of quality leaf during autumn season. The above results indicate that there is a feasibility of an additional silkworm crop in this sericulture zone of Punjab, which needs to exploit it on commercially on large scale (Shashi Kanta, 2014) [11].

A crop is possible between traditional spring and autumn crop in the form of summer crop and thus three crop schedules has been workout instead of two. Summer crop has positive impact on the autumn crop because of pruning was adopted/forced before autumn crop to improve mulberry leaf quality (Aslam *et al.*, 2019) [1].

For autumn season, SH₆×NB₄D₂ was shortlisted from previous

trials conducted at RSRS, Jammu and Dehradun. The DFLs were procured from SSPC, Dehradun and were incubated at RSRS, Jammu and REC, Ghumarwin (H.P) and brushed on 08.09.2020 and 06.09.2020 at Jammu & Ghumarwin respectively. The chawki reared worms were distributed to each location on 17.09.2020 (Lamberi, Rajouri Dist. & Majalta, Udhampur Dist.) and 16.09.2020 (Dharmkot, Kathua Dist.) at Jammu division whereas Bilaspur region (H.P) worms were distributed on 15.09.2020 having 50 DFLs (20000 worms) per rearer. The yield recorded was about 41, 37 and 44.40 Kg/100 DFLs for Lamberi (Rajouri Dist.) Majalta (Udhampur Dist.) and Dharmkot region (Kathua Dist.) respectively at Jammu division and having average yield about 40.80 Kg/100 DFLs whereas 46.70, 47.90 and 47.40 Kg/100 DFLs for Soi, Panol and Naswal region of Bilaspur, Himachal Pradesh and 39.50, 39.80, 40.70 Kg/100 DFLs for Sanot region (3 rearers) of Kangra dist., Himachal Pradesh with average yield of about 43.67 Kg/100 DFLs was recorded for Himachal Pradesh. The control batch reared at RSRS, Jammu recorded yield was about 44.75 Kg/100 DFLs (Table 4). The average filament length was recorded about 768.67 mtrs, denier (2.40), Renditta (3.01), Reelability (76.28%), Raw silk (27.31%) and Neatness (94.33) at Jammu division whereas Himachal Pradesh the average filament length was recorded about 775.33 mtrs, denier (2.35), Renditta (3.42), Reelability (73.28%), Raw silk (25.96%) and Neatness (95.33) respectively for the field trial conducted during autumn season (2020) and the control rearing at RSRS, Jammu, the filament length was recorded about 879.00 mtrs, denier (2.62), Renditta (3.15), Reelability (88.38%), Raw silk (33.26%) and Neatness (93.00) (Table 5).

Table 4: Average Data Recorded during Autumn Field trial for the Hybrid, SH₆×NB₄D₂ through Shelf Rearing (2020) at different places of Jammu & Himachal Pradesh and Control batch at RSRS, Jammu

Name of location	Date of incubation	Date of brushing	H (%)	Date of distribution	Wt. of 10 Mature Larvae (g.)	5 th Instar Larval Period (D:h)	Total Larval Period (D:h)	Actual Yield (Kg)	Av. Yield / 100 DFLs	SCW (g)	SSW (g)	SR (%)
Jammu Division (J & K)												
Lamberi, (Rajouri)	31.08.2020	08.09.2020	88.91	17.09.2020	42.00	7:02	25:05	20.500	41.00	1.729	0.342	19.80
Majalta (Udhampur)	31.08.2020	08.09.2020	88.91	17.09.2020	42.00	8:21	24:00	18.500	37.00	1.513	0.265	17.51
Dharmkot (Kathua)	31.08.2020	08.09.2020	88.91	16.09.2020	43.00	8:06	28:03	22.200	44.40	1.620	0.290	17.90
Avg.			88.91		42.33	8:02	25:19	20.40	40.80	1.62	0.30	18.40
Himachal Pradesh												
Soi (Bilaspur)	31.08.2020	06.09.2020	90.00	15.09.2020	47.00	7:22	24:04	23.350	46.70	1.75	0.315	18.00
Panol (Bilaspur)	31.08.2020	06.09.2020	90.00	15.09.2020	46.00	9:22	26:04	23.950	47.90	1.80	0.325	18.06
Naswal (Bilaspur)	31.08.2020	06.09.2020	90.00	15.09.2020	47.00	8:22	25:04	23.700	47.40	1.80	0.324	18.00
Sanot (Kangra)	31.08.2020	07.09.2020	90.00	17.09.2020	-	8:00	26:00	19.75	39.50	1.68	0.30	17.86
Sanot (Kangra)	31.08.2020	07.09.2020	90.00	17.09.2020	-	8:00	26:00	19.90	39.80	1.70	0.30	17.94
Sanot (Kangra)	31.08.2020	07.09.2020	90.00	17.09.2020	-	8:00	26:00	20.35	40.70	1.72	0.31	18.02
Avg.			90.00		46.67	8:11	25:14	21.83	43.67	1.74	0.31	17.98
Control Batch rearing												
RSRS, Jammu	31.08.2020	08.09.2020	88.91		47.00	6:09	22:04	22.376	44.75	1.654	0.303	18.41
Avg.			90.00		47.00	6:09	22:04	22.376	44.75	1.654	0.303	18.41

Note: No. of DFLs distributed: 50 DFLs; No. of Farmers covered: 9; H-Hatching

Table 5: Showing post cocoon parameters recorded for SH₆×NB₄D₂ (2020) trial rearing at Field and Control batch during autumn (2020) at RSRS, Miran Sahib, Jammu

Location	AFL (mtr)	Deneir	Renditta	Reelability (%)	Raw Silk (%)	Neatness
Jammu Division						
Lamberi (Rajouri)	728.00	2.43	2.37	75.32	30.69	93.00
Majalta(Udhampur)	764.00	2.36	3.15	80.28	31.89	95.00
Dharmkot (Kathua)	814.00	2.41	3.50	73.24	19.35	95.00
Avg.	768.67	2.40	3.01	76.28	27.31	94.33
Himachal Pradesh						
Soi (Bilaspur)	780.00	2.49	3.06	75.04	32.86	98.00
Panol (Bilaspur)	698.00	2.22	3.87	70.11	25.97	93.00

Naswal (Bilaspur)	848.00	2.35	3.33	74.68	19.05	95.00
Avg.	775.33	2.35	3.42	73.28	25.96	95.33
Control Batch						
RSRS, Jammu	879.00	2.62	3.15	88.38	33.26	93.00
Overall Avg.	787.29	2.41	3.20	76.72	27.58	94.57
SD	64.41	0.12	0.46	5.96	6.21	1.81

Note: AFL – Average filament length; SD-standard deviation

New date of brushing has been assessed which suggest that Spring crop in the region needs to be preponed by a week over the traditional date(s), Summer crop can be conducted in the month of June between 2nd to 4th week and autumn crop to be postponed by a week over the traditional date of brushing specially in two major sericulture states *i.e.* Jammu region (Sub tropical) of J & K and Himachal Pradesh respectively (Singh and Murali, 2019) [10].

Similar studies conducted by Aslam *et al.* (2019) [11] revealed that, in spite of the fact that the climatic conditions of Uttarakhand are congenial for bivoltine silkworm rearing specially for district Dehradun but only spring silkworm crop is being exploited at farmer's level and autumn crop has yet to be stabilized. The main reasons, as observed, are high temperature, high humidity and bad quality of mulberry leaves during autumn rearing. The temperature and humidity prevailing during rearing season could be manipulated but the leaves quality needs to be improved for silkworm rearing. Keeping in view, summer crop has been taken for study. An average cocoon production was 40.02 Kg and 36.66 Kg /100

DFLs during summer season 2018 and 2019 respectively in West Dehradun. The farmers conducting silkworm rearing in summer season harvest mulberry leaves bloomed after spring crop harvest and again a fresh harvest during autumn season. This also affects on the performance of autumn silkworm crop and sericulture activity becomes more remunerative with spring, summer and autumn crops in a row.

Impact on autumn crop by introduction of summer crop:

Measured in terms of *percent* gain over existing practices after diffusions of knowledge and innovation and introduction of summer crop in between spring & autumn crop.

The average yield recorded by project adopted rearers in Jammu division of J&K during autumn season was about 40.80 Kg and HP was recorded about 43.67 Kg/100 dfls respectively. The *percent* yield gain over traditional field rearing from experimental field trial revealed that 67.14 (%) and 44.70 (%) gain record in autumn season at Jammu division and Himachal Pradesh in the same area respectively (Table 6).

Table 6: Showing Percent yield gain by Experimental field trial V/s Traditional field trial during autumn season (2020)

Particulars	Autumn season (2020) Average Yield (Kg)	Yield gain over traditional rearing (%)
Jammu division		
Experimental field trial	40.80	67.14
Traditional field trial	24.41	
Himachal Pradesh		
Experimental field trial	43.67	44.70
Traditional field trial	30.18	

The summer crop is completed in the month of July last and fresh leaf is available for next autumn crop. This may helps in improvement in autumn silkworm crop performance and it is inferred that those farmers who are not opting for mulberry pruning after spring crop should take summer crop and sericulture becomes more remunerative.

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