Review Article

A REVIEW ON STATUS AND PROSPECTS OF LEGUMES VIRAL DISEASE IN NEPAL

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ABSTRACT

Viral diseases are the important diseases of legumes as these cause great losses in legumes of Nepal. Research on viral diseases is very less in Nepal. Disease caused by Mungbean Yellow Mosaic Virus (MYMV) and Mungbean Yellow Mosaic India Virus (MYMIV) in kidney bean, black gram and mungbean, Bean Common Mosaic Necrosis Virus (BCMNV), Bean Common Mosaic Virus (BCMV), Southern Bean Mosaic Virus (SBMV) and Bean Yellow Mosaic Virus (BYMV) in common bean, Pea Leaf Distortion Virus (PLDV), Cowpea Aphid Borne Mosaic Virus (CABMV), Soybean Mosaic Virus (SMV), Mungbean Yellow Mosaic Virus (MYMV), Pigeon Pea Sterility Mosaic Virus (PSMV) in pigeon pea, SBMV, Tobacco Ring Spot Virus (TRSV), MYMV in soybean, CABMV, Cucumber Mosaic Virus (CMV), Cowpea Severe Mosaic Virus (CPSMV), BCMV, MYMV in cowpea, Pea Seed-Borne Mosaic Virus (PSBMV) in pea, lentil and broad bean, Alfalfa Mosaic Virus (AMV) in chickpea are the major viral diseases of legumes recorded in Nepal. This article reviewed most of the research carried out in Nepal and provides insight on their occurrence, etiology, host range, and varietal resistance. The article is helpful for future research strategies.

Key words: *Legume crops, Nepal, research, vector transmission, viral diseases.*

INTRODUCTION

The unique agro-ecological zones favored by altitudes, topography, and aspect within the country offer an immense opportunity for growing different types of crops. Grain legumes occupy about 11% of the total cultivated land of the country and rank fourth place in terms of area and production after rice, maize and wheat. Also, some grain legumes have a good scope as export commodities (lentil as whole/split seed as dal). The yield of lentil in Nepal (1.2 mt/ha) is better than producers like Bangladesh (1.09 mt/ha), India (0.74 mt/ha) and Pakistan (0.52 mt/ha) (FAOSTAT 2019). The major grain legumes grown in Nepal are lentil (*Lens culinaris* Medikus), chickpea (*Cicer arietinum* L.), soybean (*Glycine max* L. Merril), blackgram (*Vigna mungo* L. Hepper), pigeonpea (*Cajanus cajan* L. Millsp.), cowpea (*Vigna*

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unguiculata L. Walp), mungbean (*Vigna radiate* L. Wilczek), ricebean (*Vigna umbellate* L. Ohwi and H. Ohashi), horsegram (*Macrotyloma uniflorum* L.), kidney bean/ common bean (*Phaseolus vulgaris* L.), fababean (*Vicia faba* L.), Grasspea (*Lathyrus sativus* L.), field pea (*Pisum sativum* L.). Cultivation of lentil, chickpea, mungbean, cowpea and pigeon pea are concentrated in the terai region where more than 80% of the area and production of grain legumes are recorded and that of soybean, cowpea, black gram and horse gram in mid-hills (Pokhrel *et al.*, 2018).Winter grain legume crops are more important than summer legumes in terms of area and production, while the summer grain legumes are the major in the hill and mountain regions of the country.

Viral diseases are important in legumes as it cause great losses in legumes. Incidence and severity of viral diseases is increasing and new virus like diseases are also emerging. While research on viral diseases is very less in Nepal, primarily because of the lack of adequate technical manpower, research facilities suitable for virological studies and financial resources.

Virus is a sub microscopic, obligatory infectious agent, lacks its own metabolism and depends on a living host cell for multiplication. Simply it is a nucleoprotein that has ability to cause disease. It possesses either DNA or RNA but never both, either in one strand or in a few segments encapsulated together or separately within a coat of one or more types of protein, sometimes with an extra coat and some other constituents. Several virus and virus-like diseases have been recorded in leguminous crops in Nepal among which, the Poty viruses are the most common. The importance of true viral diseases and loss in plant yields have not been well appreciated by most plant pathologists and agricultural planners. Viral diseases management particularly in leguminous crops is most essential. This article reviewed most of the research carried out in Nepal. The article is helpful for future research strategies on their occurrence, symptomatology, etiology, host range, vector transmission, and varietal resistance and outline their importance on grain/pulses production and have attempted to open the door for future research and strategy.

METHODOLOGY

Necessary information of the major legume viral diseases, their causal organisms, distribution, host crop, symptoms, survival, spreads, environmental factors for disease development on grain legume diseases of Nepal are collected through various literature and the available publications. Relevant information were arranged systematically. Findings are summarized in the texts with definite review of the major viral diseases of legume crops in Nepal.

RESULTS AND DISCUSSION

Phytovirological research on legume crops in Nepal and their major achievements

In Nepal, research on grain legumes i.e. soyabean, blackgram, mungbean and chickpea was started in 1972 AD at Regional Agricultural Research Station (RARS), Parwanipur, Bara and Agronomy Division, Khumaltar, Lalitpur. Later in 1978, Grain Legumes Research Project (GLRP) was established at Khumaltar to strengthen grain legume research and development in the country. It was given national status and named as National Grain Legumes Improvement Program (NGLIP) in 1985 with headquarters in Rampur, Chitwan. After the establishment of Nepal Agricultural Research Council (NARC) as an autonomous institution in 1991 AD, the program was renamed as National Grain Legume Research Program (NGLRP).The research programs were greatly strengthened and systematized after the establishment of this program. The mandate crops of the program are lentil, chickpea, grasspea, kidney bean/ rajma and field pea in winter and soybean, blackgram, mungbean, pigeonpea, cowpea, ricebean and horse gram in summer season.

Plant pathology division of Nepal Agricultural Research Council (NARC) possesses laboratory facilities for preliminary work in plant virological research. Outside the division, Agriculture and Forestry University, Rampur, Department of Botany, Tribhuwan University, Kritipur, National Potato Research Program (NPRP), Khumaltar also possess a few other laboratory facilities for plant virology. Reports made on identification and occurrence of viral diseases is mainly based on visual symptomatological observations expressed by the crop plants in natural conditions and serological test. Growing on test, indicator host plant test, serological test (ELISA) (based on the availability of antiserum), PCR, electron microscopic studies, growing-on test followed by DAC ELISA, indicator plant assay are some of the diagnostic methods which are being practiced in Nepal. Research on plant virology is at its infancy in Nepal. These studies are periodic and have not covered all the legumes and growing areas. There is very limited study on virus characterization, crop loss, and epidemiology and control measures. Although viral diseases in legumes are widespread and are responsible for significant yield loss, only a few viral diseases have been systematically studied in detail and identified in collaboration with foreign scientists. Lack of well-equipped laboratory in reference to virological work, lack of technical expertise are major research constraints on plant virus in Nepal (Dahal, 1984; Amatya and Manandhar, 1986).

Despite this limitation, there have been several viral diseases recorded by the Plant Pathology Division, NARC and other institutions. Different virus-like symptoms have been reported from the experimental plots of Institute of Agriculture and Animal Science (IAAS) farm (Timilsina, 1988; Neupane and Pant, 1988) and farmer's field of Chitwan district. Disease caused by Mungbean yellow mosaic virus (MYMV) and Mungbean yellow mosaic India virus (MYMIV) in kidney bean, blackgram and mungbean, Bean common mosaic necrosis virus (BCMNV), Bean common mosaic virus (BCMV), Southern bean mosaic virus (SBMV) and Bean yellow mosaic virus (BYMV) in common bean, Pea leaf distortion

virus (PLDV), Cowpea aphid borne mosaic virus (CABMV), Soybean mosaic virus (SMV), MYMV, Pigeon pea sterility mosaic virus (PSMV) in pigeon pea, SMV, Tobacco ring spot virus (TRSV), MYMV in soybean, CABMV, Cowpea mosaic virus (CMV), Cowpea severe mosaic virus (CPSMV), BCMV, MYMV in cowpea, Pea seed-borne mosaic virus (PSBMV) in pea, lentil and broad bean, Alfalfa mosaic virus (AMV) in chickpea are the major virus diseases of legumes recorded in Nepal. Epidemic of some of these viral diseases are causing havoc with negative impact on the economy of the farmers. Whitefly (*Bemisia tabaci* Genn.) transmitted MYMV has been a serious threat to blackgram, soybean, mungbean and cowpea production in terai /inner terai and foot hill. Yield losses up to 100%, 52.6% and 21% have been reported due to MYMV in blackgram, mungbean and soybean, respectively (Darai *et al*., 2016).

Yellow or golden mosaic on cowpea, mungbean, soybean was observed up to 100% incidence in Chitwan and the etiology of many of these diseases are remained to be clarified (Dahal *et al*., 1988; Dahal *et al.*. 1990). New virus like diseases is also emerging. Crop or yield losses incurred due to specific virus in specific crop in Nepal are not yet studied. Past and the present virus disease scenario indicated that the occurrence of several viruses on legumes and other crops are in epidemic form in the country. In recent years, viral diseases are appearing as economically important diseases for some of the major legume crops.

The most serious plant viral diseases are transmitted by whiteflies followed by those which are transmitted by aphids, leafhoppers, beetles, thrips and mites (Bhargava, 1994).The viruses of major economic importance on cool season legumes belong to the Luteoviruses, Nanoviruses, Potyviruses, Carlaviruses, and Furoviruses. In Nepal Potyviruses are the most important overall causing economically important diseases in grain legumes. During the last few years, occurrence of virus-like disease on several legume crops in Nepal causing serious effects on their growth and yields have been reported. Etiology of many of these diseases is remained to be clarified (Dahal *et al*., 1988). Combined infestation of more than two viruses at a time in a particular crop is seen in most of the legumes field of Nepal. Before, very limited work was done on identifying cultivars resistant to virus like diseases in Nepal (Dahal *et al*., 1988) and there are not enough resistant varieties develop against legume viral disease in Nepal till date.

Major viral diseases of legume crops in Nepal

The major grain legumes in Nepal and the virus affecting them are described below:

Cowpea

Cowpea (*Vigna unguiculata* L. Walp), known as bodi in Nepali, is one of the important grain legumes either consumed as a green pod vegetable or dried pulses as dal. In a field surveyed at 94 sites in Chitwan and Nawalparasi districts of Nepal, CMV disease (suspected to be CGMV) was observed in 89 fields on which percentage of infected plants ranged from 22 to 100% with a mean of 84.5% (Karki, 1990). The leaf extracts from cowpea samples

reacted strongly to antibodies against cowpea aphid-borne mosaic potyvirus (CABMV) in immunosorbent electron microscopy (Dahal *et al*., 1996). A survey in Chitwan in cowpeas (cv Tanebodi and Katikebodi) reported yellow mosaic symptoms (Dahal *et al*., 1989).Occurrence and spread of several virus-like diseases of cowpea based on symptomatology were also reported by Dahal and Albrechtsen (1996). PSbMV were detected in leaf extracts of seedlings with typical virus-like symptoms of cowpea through ELISA test (Dahal *et al*., 1996).

Among the tested 96 cowpea genotypes against Cowpea yellow mosaic virus (CPYMV) disease in 1-6 scale 15 genotypes including IT 93K-2046-2, IT 84E-24, IARS- 48, IT 95K-1380, IT 00K-898-5, IT 07K-291-69, IT 07K-303-1, IT 04K-339-1, IT 07K-318-33, IT 07F-187-24, IT 07K-291-92, IT 10K- 836-2, IT 10K-836-2, IT 07K-249-1-1, IT 04K-227-4 possessed resistant to Cowpea yellow mosaic virus disease (GLRP, 2015/16).

Chickpea:

Eight varieties of chickpea have been released and recommended. Alfalfa mosaic virus (AMV) in chickpea has been reported from India, Pakistan, Bangladesh and Nepal (Nene *et al.*, 1996). Infection during early stages leads to a total loss. Because of its leguminous host range this viral disease can cause serious losses to grain legumes such as fababean, lentil, and pea.

Soyabean:

Soyabean (*Glycine max* L. Merril) is second most important food legume of Nepal which shares about 7 % out of total legumes area. The virus diseases of soybean in Asia have been reviewed by Goodman and Nene (1976) and Sinclair (1982).Soybean is susceptible to several viruses transmitted by aphids, beetles and whiteflies prevailing in Nepal. Mungbean yellow mosaic virus transmitted by whitefly is the most common virus associated with soyabean mosaic disease in Nepal and the soyabean variety Myagdi 1, PK 327, CM 9125, G 8754, LS-77-16-16, PI 36859, SB0065, SB 0095, Shinano Hiramame, G 1871 were found resistant to MYMV(Darai *et al*., 2016). Manandhar (1977) observed the disease caused by SMV an economically important disease in the trials in all locations (Kathmandu, Kakani, Bhairahawa, Parwanipur) and the disease was more uniformly distributed at terai locations than in the hills. Manandhar (1979) reported that the diseases caused by bud blight virus and soybean mosaic virus were important diseases found in the best adapted variety Hardee (for terai) during a field trip to Sarlahi. Based on field symptoms, Sinclair reported presence of a yellow mosaic disease in the terai but such a yellow mosaic symptom could be caused either by bean mosaic or by one of four other common viruses (Sinclair and Backman, 1989). Heavy infection of soyabean mosaic virus in Williams, Calland, Forest, Hardee and Davis, whereas improved Pelican, Jupitar and Bragg varieties of soyabean were found free from SMV (Manandhar, 1975). Based on an extensive survey carried out in 1977, 1978, 1979, J.B. Manandhar and J.B. Sinclair reported the occurrence of three viral diseases of soyabean in Nepal viz. disease caused by SMV, bud blight caused by Tobacco ring spot virus (TRSV)

and a disease caused by yellow mosaic virus (Amatya *et al*., 1986). Rajbhandary and Ranjeet (2001) reported Soybean mosaic virus, Bud blight (Tobacco ring spot) in Soyabean.

Out of 151 soybean entries in disease screening nursery Joshi (1980) found 21 entries of soyabean susceptible to SMV, 6 entries with SYMV, 5 entries with bud blight caused by the TRSV. Gyawali (1982) reported the presence of two aphids, *Aphis glycine* and *A. gossypii* and whitefly (*Bemisia tabaci*) in soybean acting as vector for viral disease transmission.

MYMV appeared in epidemic form in Rampur, Chitwan in soybean genotypes regarded resistant in previous year were found susceptible during this season (GLRP, 2010/11). SMV was found higher in early plantings in a trial conducted in NGLRP (GLRP, 2012/13). In an experiment conducted at NGLRP, among the tested 48 soybean genotypes against SMV, genotypes like IPBSY 178, PI 200451-2, 272 W, Gorkha Local, and Coll # 5 Sirke were resistant (2 in 1-5 scale) and standard check Puja was found moderately resistant while Cobb was moderately susceptible to SMV (GLRP, 2012/13).

Soybean genotypes C0176, C0172, C 2024, C 2026, C 2027, C0157, C0161, G-8514, PI 368055, G-757, Coll #5 Sikre, G-18428, TGX-1990-5F, 200525 (Rampur), G-758, C0164, 272W, SB 0103, G 8514 and SB0095 were found free from SMV disease (GLRP, 2013/14).Similarly among the tested soyabean genotypes AGS-87-4 possessed highly resistance to SMV disease in 2016 (GLRP, 2016/17). MYMV is the important diseases of soybean observed in terai/ inner terai region of Nepal and abundance of weed hosts specially *Ageratum* spp. has been one of the major causes of high disease severity in Chitwan, (Darai *et al*., 2016). Darai *et al*. (2016) also reported that soybean genotypes CM9125, G8754, LS-77-16-16, SB0065 and SB0095 showed resistant to MYMV and Chaing Maw 60-63, CM9133, Dhankuta and SJ-4 were moderately resistant in physical observation. The disease prone areas are hot and humid areas of terai/inner terai and foot hill.

Mung bean / blackgram:

Mungbean (*Vigna radiata* L. Wilczek), is a short duration (60-70 days) crop grown as rainfed bari land (after maize) and lowland irrigated areas of terai and inner terai (after wheat). Srivastava (2010) reported that two mungbean cultivars, Pratikshya and Kalyan confer resistance to MYMV. While screening mungbean and blackgram against MYMV, IPM-16 genotype of mungbean was found highly resistant whereas three genotypes of blackgram, Bari Mash-1, Bari Mash-2, and Bari Mash-3 and three genotypes of mungbean, Bari Mung-2, Pratikshya, and Hum 12 were found resistant (Gharti, 2013). According to Gharti (2013), spraying of cow milk and botanical leaf extracts were effective to reduce severity of this virus and increased yield amount and quality.

Shrestha and Manandhar (1983) screened 44 germplasm lines of mungbean for resistance to the MYMV at Parwanipur and Bhairahawa, Nepalgunj and Khumaltar under field conditions where all tested entries were found susceptible to infection, but the degree of infection varied considerably. The severity of infection was higher in the July planting than

in the April planting. This might be due to higher population of the possible vector, white flies, in July. MYMV has been found as the most important threat to summer legume cultivation in chitwan and similar locations with high temperature and high relative humidity (GLRP, 2013). Rajbhandary and Ranjeet (2001) reported Yellow bean mosaic virus in Mungbean and Joshi *et al*. (1993) recorded Bean common mosaic potyvirus (BCMV) from black gram seed.

MYMV was observed in blackgram which was moderate in mungbean (GLRP, 2010/11). An experiment was conducted to evaluate the efficacy of botanicals insecticides for the management of whitefly, vector of MYMV of Blackgram on which Spinosad (Tracer) @ 0.5 ml/l was found effective for the management of whitefly, similarly lower disease severity (1.25) and higher crop yield (439 kg ha–1) on mungbean and blackgram was observed on the plot treated with Allfighter (Chloropyrifos + Cypermethrin) @ 1.5 ml per liter of water (GLRP, 2013/14). Blackgram genotypes BLG 0035- 1, BLG 0003-2-1, BLG 0068-1, BLG 0092-1 and BLG 0069-1 and Mungbean genotypes IPM-01-03, IMB-37, Meha, Sukumar, Pusa Vishal, VO 6008 (B-G), HUM-16, VO 2023 (A-B), 5248 Chitwan, Kalyan, VC 6375 (41-113-6), 5242 Chitwan, 5229 Dang and VC 6173 C were found free from MYMV disease (GLRP, 2013/14, 2014/15).Similarly genotypes BLG0036-1, BLG0068-1, BLG0078-1, BLG0068-3, BLG0041-1, BLG0038-1, BLG0076-2, and BLG 0066-1-1 were recorded MYMV disease free also possessed resistant to MYMV disease (GLRP, 2015/16).Whereas during 2016/17 none of the tested genotype was highly resistance, however, BLG0016-1 possessed resistance (GLRP, 2016/17). Among 35 mungbean genotypes screened against MYMV, only 1 genotype PM-2 possessed high resistance category on which Pratikshya as a check variety possessed a resistance category (GLRP, 2016/17).

Pigeon pea:

Pigeon pea (*Cajanus cajan* L. Millsp.), locally called arhar, is an important grain legume in drier areas of central and mid-western terai, and in the mid hills and are commonly planted as a bond crop or in a small fallow land as a catch crop. Sterility mosaic disease caused by PSMV is the most important foliar disease of pigeonpea in India and Nepal (Reddy and Vishwadhar, 2000). The virus causes mosaic symptoms on leaves and infected plants do not flower thus named sterility mosaic (Darai *et al.*, 2016). In Nepal this disease is widespread in the terai and the inner terai and affects the yield causing completely or partially sterile flowers. Rajbhandary and Ranjeet (2001) reported Pigeon pea sterility mosaic virus in Pigeon pea. The MYMV and PSMV have also been reported in Nepal (Nene *et al*., 1996).

Pea:

Pea (*Pisum sativum* L.) is an important crop which is established as a winter crop in plain area (<100 masl) and a summer crop in high mountains (3000 masl) (Khadka, 1987). Dahal (1990) reported high incidence of virus like symptoms on two pea cultivars, Arkelle and Boneville, when planted during January-February. Shrestha *et al.* (1989) and Dahal *et al.*

(1990) reported pea seed borne mosaic virus (PSbMV) through enzyme-linked immunosorbent assay (ELISA) from virus infected pea plants in Nepal. This important virus of pea is mainly transmitted by seed and aphid to several other legume species. Electron microscopic study of symptomatic leaf extracts showed the prevalence of PSbMV in Rampur, Chitwan (Dahal and Albrechtsen, 1996) while Shahid *et al.* (2017) also reported Pea leaf distortion virus (PLDV) from the same locality. Rajbhandary and Ranjeet (2001) reported Alfalfa mosaic virus, Pea seed-borne mosaic virus in pea. Dahal and Albrechtsen (1996) also reported cowpea aphid borne mosaic potyvirus (CABMV) in pea during 1989–1990 at Rampur, Chitwan which were transmitted by aphids via sap inoculations. Several virus-like symptoms were reported in the experiments conducted at IAAS farm and farmers' field of Chitwan district (Timilsina, 1988; Neupane and Pant, 1988). The incidence was higher in the late-planted pea crop (January) than in those planted in November and December (Dahal *et al*. 1996).

Lentil:

Lentil (*Lens culinaris* Medikus), locally known as Masuro, is the first important legume crops in terms of area and production in the country accounting for about 59%, of area and production under grain legume. Lentil seed samples tested at different time intervals were observed to be infested with PSBMV (Joshi *et al*. 1993). Lentil yellows is the most widespread and important virus disease of lentil which is caused by several related luteo viruses such as bean leaf roll virus (BLRV), beet western yellows virus (BWYV), or subterranean clover red leaf virus (SCRLV). In December 2010, lentil showing severe mosaic, yellowing and leaf curling symptoms were observed with 70-80% disease incidence in Chitwan (Darai village, Pakaudi, Pokhara, Rampur and Malepatan) from which total DNA was extracted from eleven plants with symptoms and three plants without symptoms, results revealed that bands typical of begomoviruses in all samples with symptoms, but not for symptomless ones, indicating the association of a begomovirus with the disease. Joshi *et al.* (1993) indicated that aphid transmitted PSbMV was detected from seeds of lentil collected from the eastern hills (Dhankuta) and Kathmandu valley (Kathmandu and Lalitpur).

Bean:

Common bean (*Phaseolus vulgaris* L.) is an important grain legume grown throughout the mid hills for green pods and dry seeds which is a cash-generating crop and farmers grow a number of landraces with varying morphology (Neupane and Vaidya, 2002). Rajbhandary and Ranjeet (2001) reported Bean common mosaic virus in Bean. Shrestha *et al.* (1989) reported BCMV like disease of bean in Kathmandu valley and in other bean growing areas of the country and also emphasized the risk of introduction of BCMV into new areas through infected seeds. They reported that the disease was becoming a severe problem in some vegetable growing areas of Nepal. In Nepal, BCMNV was first reported from sweet

bean in December, 2010. The diseased plants exhibited symptoms like mottle and leaf deformation, severe mosaic, necrosis, malformation of leaves (Pudashini *et al*., 2013).

Kidney bean:

Kidney bean (*Phaseolus vulgaris*) is an important legume crop that is grown widely in Nepal. During 2010 at Rampur, Chitwan, Utkarsha genotypes was recorded as moderately resistant and cow's milk spray was effective and BCMV was moderate in early and late planting for BCMV management (GLRP, 2010/11). Shahid *et al.* (2012) first reported MYMIV in kidney bean from vicinity of Chitwan, Nepal. The typical characteristics of the infected plants showed severe mosaic, yellowing and leaf curling symptoms and the disease incidence was 70-80%.

CONCLUSION

In this review, common viral diseases of legumes especially in context of Nepal have been discussed. During the last few years, there has been a growing awareness of the impact of legume virus diseases. Now, the major emphasis is in identification, survey and surveillance of common viral diseases of legumes and identifying best detective methods through collaboration with international agencies and expansion of developed technology by increasing the awareness of farmers. A necessity to identify and characterize viral diseases has been emphasized to develop appropriate and economical strategies for the management of legume viral diseases in Nepal. Seed transmission studies on seed-borne virus diseases of legumes crop, host resistance screening; alternative management tools for integrated management, should be carried out. The reported virus like diseases of legume plants in Nepal requires identification of the causal agents and the legume virus need to be described and further characterized. The review showed that disease caused by MYMV and MYMIV in kidney bean, blackgram and mungbean, BCMNV, BCMV, SBMV and BYMV in bean, (PLDV, CABMV, SMV), YMV, PSMV in pigeon pea, SMV, TRSV, MYMV in soybean, CABMV, CMV, CPSMV, BCMV, MYMV in cowpea, PSBMV in pea, lentil and broad bean, AMV in chickpea are the common viral diseases affecting the legume crops in Nepal. Cultivation of resistant cultivars is the cheapest and most effective method of plant disease management. Insecticidal control of vectors is the only method adopted in Nepal under the current conditions and a common practice is the early removal of virus infected plants to reduce the inoculum potential. Observation of large number of viral diseases in legume crops poses a major challenge to the production of healthy seeds in Nepal and the country may have a significant problem of viruses in legume crops in near future. Regulatory control to prevent spread of diseases through plant quarantine and seed certification is another major step to alleviate viral disease dissemination. It is thus suggested that research program to control these viral diseases and their potential vectors should be implemented before the situation becomes uncontrollable.

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